

THE ECONOMICS OF IRRIGATED SPECIALTY CROP
PRODUCTION IN SOUTHEASTERN
OKLAHOMA

By
JEFFREY FRANCIS DALE
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Thesis Approved:

Raymond Joe Schabert
Thesis Adviser
James R. Nelson
Gerald A. Doehsen
Norman N. Durham
Dean of the Graduate College

12598-17

PREFACE

The purpose of this study was to investigate the economics of irrigated specialty crop production in the southeastern portion of the state of Oklahoma. Water collection structure cost curves were approximated for three scenarios, 1) individual producers, 2) irrigation districts, and 3) irrigation districts financed with available state guaranteed low interest bond funds. Structure costs, in addition to production information for seventeen specialty crops, were incorporated into a linear programming model designed to maximize net returns for the farm operation.

Irrigated specialty crop production supported by an individual financed, on-farm water collection structure was estimated to generate substantial profits to producers. It was estimated that producers who opt to join a multi-member irrigation district to take advantage of economies of size in the construction of water structures, experience even greater returns. The economic value of the available state guaranteed low interest bond funds is restricted to the amount of the interest saved in the financing of the irrigation system.

My sincere appreciation is extended to my academic adviser, Dr. James R. Nelson, for his support and advise. The professional opportunities I had during my association with Dr. Nelson will undoubtedly prove invaluable in my professional life. The considerable effort put forth by my thesis adviser Dr. Raymond J. Schatzer deserves

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For an individual to accomplish any task, the person must be provided the opportunity to do so. I extend my heartfelt thanks to our department head, Dr. James E. Osborn and the graduate committee chairman, Dr. Daniel S. Tilley for allowing me the opportunity to study advanced Agricultural Economics here at Oklahoma State University. Also the Oklahoma Agricultural Experiment Station and the Oklahoma State University Center for Water Research deserves my gratitude for providing funds which made this research possible. I also wish to thank the researchers here at Oklahoma State, who provided the base for other researchers to build upon. Notably, Drs. Tilley and Schatzer and graduate student Mike Wikewire.

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CHAPTER I

PROBLEM SITUATION

Introduction

Southeastern Oklahoma's largely agricultural based economy has historically lagged behind the state's economy. Oil, agriculture, and manufacturing, in general, have combined to generate substantial economic activity in most other portions of the state. In southeastern Oklahoma (see Figure 1) however, the absence of substantial petroleum and industrial development has resulted in a local economy heavily reliant on agriculture as the sole provider of economic activity and opportunity.

In December of 1985 the unemployment rate for the state of Oklahoma was 7.1 percent while the unemployment rate for southeastern Oklahoma was 13.0 percent (Oklahoma Employment Security Commission, 1985). In 1982, per capita personal income for the state of Oklahoma was 11,247 dollars, while per capita personal income in southeastern Oklahoma was less than 8,000 dollars. In two counties in southeastern Oklahoma, Atoka and Pushmataha, per capita personal incomes were less than half the statewide average (U.S. Department of Commerce, 1984a).

Over 60.0 percent of the business proprietors in southeastern Oklahoma are farm proprietors. Due to the large proportion of the existing infrastructure related to agriculture, the area's economy

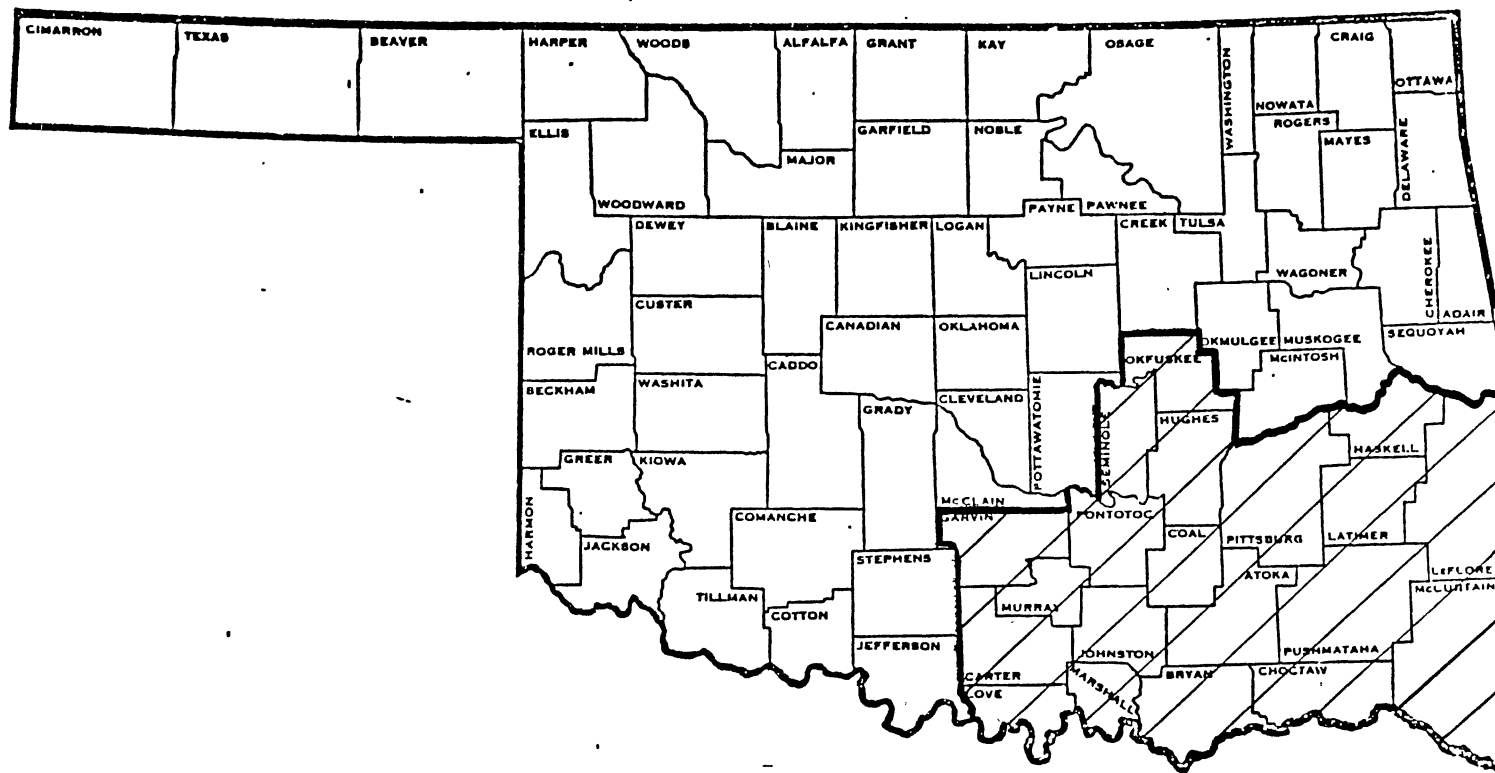


Figure 1. Study Area

should be responsive to changes in the agricultural sector. Unfortunately, agriculture in southeastern Oklahoma is characterized by small and generally low income farms (Walker et al., 1983). The average size farm in the area is 328.0 acres as opposed to the state average of 466.0 acres. More importantly, nearly one-third of the region's farms have less than 100.0 acres while only 16.0 percent of the state's farms have less than 100.0 acres.

In 1982, gross sales per farm in the southeastern region averaged approximately one half of the gross sales per farm for state farms, 17,385 dollars and 34,886 dollars, respectively. In fact, over 70.0 percent of the farms in the southeastern part of the state had sales of less than 5,000 dollars (U.S. Department of Commerce, 1984b). Because of these conditions, economic development to improve the welfare of southeastern Oklahoma has become a priority for many government officials and agencies at the local, state, and federal levels.

Research indicates that there may be significant potential for producing and marketing fresh vegetables on small plots in southeastern Oklahoma (Schatzer, R.J. et al., 1986; Sleper, J. et al., 1984). This potential for success has led researchers to believe that efforts should be made to develop such an industry in hopes of improving the welfare of the individuals living in the area.

The initial specialization of an area in the production of a good is the first step in area development. With this initial step comes increased demand for complementary goods. Increased demands will attract supply firms as well as firms involved in the processing and transportation of locally produced goods. The desired final product of these initial and intermediate steps is the development of a productive,

diversified economic base.

This simplified pattern of area development is what policymakers hope will transpire from the establishment of a specialty crop industry in southeastern Oklahoma. The successful development of a specialty crop industry could generate demands for inputs such as fertilizers, chemicals, equipment, land, and other factors of production. This increased demand for inputs will attract new input suppliers and generate employment opportunities for the workers operating the input firms. Jobs will also be generated in product handling firms (processing and transportation). In addition to these secondary benefits, there will be direct benefits accruing to the agricultural sector in the form of increased net revenues and economic activity. In the end, such direct and secondary benefits from specialty crops may result in an overall increased level of economic activity in the long dormant southeastern Oklahoma economy.

Industry Concerns

Though south Oklahoma producers have production experience in growing specialty crops, most of this experience has been growing crops on a "home garden" scale for household consumption or for local markets. Commercially successful specialty crop production requires more intensive use of resources such as marketing and production skills, hired labor, and irrigation water. Common concerns of new commercial specialty crop producers are addressed in an OSU Fact Sheet (Tilley and Schatzer, 1985).

Substantial research has been conducted at Oklahoma State University on production of specialty crops. An abundance of commercial

specialty crop production information has been compiled by scientists at Oklahoma State University regarding such topics as desired varieties, growing methods, and chemicals (Campbell, 1980; Criswell and Barnes, 1983; Motes, 1983). Agricultural economists at Oklahoma State have emphasized the marketing and economics of specialty crop production (Tilley, 1984; Wickwire, 1985; Schatzer, et al., 1986; Sleper, 1984). Selected works on specialty crop marketing and production are discussed in the literature review section of this thesis.

Another vital input for specialty crop production which has received minimal attention by researchers to date is labor. Securing sufficient labor for peak labor demand periods such as harvesting periods could potentially be the most difficult task for commercial vegetable producers in southeastern Oklahoma. Without adequate labor, the effectiveness of planting, maintenance, and harvesting will diminish, resulting in reduced quality, yields, and profits for specialty crops.

In spite of the historically high unemployment in southeastern Oklahoma, it is argued by many, that few of the harvesting jobs will be desired by unemployed locals. The ability to attract adequate migrant and seasonal labor to satisfy the labor demand for harvesting commercial operations could prove to be the critical factor in the success and magnitude of a commercial specialty crop industry.

The possibility exists that the production of specialty crops, in the event adequate labor is not attracted, may become concentrated on small, limited resource farms or family operations. Families of sufficient size can minimize the labor problem by using available unpaid family labor. Therefore, much of the potential for a specialty crop

industry increasing the welfare of persons in southeastern Oklahoma, may be with the small family operations which, in fact, most need the benefits.

The final major concern of local producers and agriculturalists is one of the availability of sufficient water for irrigation. Researchers agree that to ensure acceptable quality and quantity of commercially grown specialty crops, irrigation practices should be adopted (Sleper, 1984; Motes, 1985).

Problem Statement

Though annual rainfall sufficient for vegetable production occurs in southeastern Oklahoma (approximately 40 inches), the rain cannot be relied upon to meet commercial specialty crop water requirements in a timely manner. The adoption of irrigation practices would facilitate the timely application of water to specialty crops. This timely water application would help ensure that crops receive water when their biological needs are highest.

Although there are exceptions, ground water is not generally feasible as a source of irrigation water in southeastern Oklahoma. The Antlers, Arbuckle, and Arkansas Novaculite formations are the three aquifers present in the area. The dominant aquifer, the Antlers aquifer, is a large, high quality aquifer close to the surface. The aquifer underlies a large portion of the southern border counties in the southeastern region.

Though the Antlers appears to be a viable source of groundwater, data indicates that the actual output may be inadequate. Table I shows the yields and depth to water for wells, test holes, and springs from

TABLE I
WELL DEPTH TO WATER AND YIELD FOR
THE ANTLERS AQUIFER, BY COUNTY

County	Depth to Water (ft)			Yield (gal/min)		
	(Mean) ¹	(n) ²	(Dev.) ³	(Mean)	(n)	(Dev.)
Atoka	32	68	25	07	34	08
Bryan	89	38	35	53	35	92
Carter	33	09	10	40	01	00
Choctaw	50	48	38	71	35	139
Johnston	37	26	32	15	15	20
Love	66	26	57	38	17	65
Marshall	105	31	78	71	19	122
McCurtain	48	54	45	23	33	35
Pushmataha	18	26	16	13	24	13

¹ Mean of the survey observations

² Number of observations in the survey

³ Standard Deviation of the 'n' observations

Source: Oklahoma Geological Survey, 1981.

the Antlers aquifer (Oklahoma Geological Survey, 1981).

As indicated in Table I, mean depth to water in the aquifer is quite modest. The depths range from 18.0 feet in Pushmataha county to 105.0 feet in Marshall county. Yield data for the aquifer ranges from seven gallons per minute in Atoka county to 71.0 gallons in Choctaw county. A yield accepted as adequate for practical application of irrigation water is 40.0 gallons per minute. Of the nine counties overlying the Antlers aquifer, six of these counties had mean yields less than 40.0 gallons per minute. Four of the mean yields were 24.0 gallons or less. Also evident in the yield data was a high degree of deviation.

Due to the high degree of uncertainty associated with the use of groundwater from the major aquifer in the area, the Antlers aquifer, it is advisable to look to sources other than groundwater to support most of the potential irrigated specialty crop production.

Furthermore, the spatial distribution of existing surface water sources prohibits the use of these sources as feasible and accessible sources of irrigation water. However, individual producers contemplating specialty crop production, yet lacking adequate water resources, could develop on-farm surface water collection facilities to support specialty crop production. These on-farm surface water collection structures could facilitate the collection and retention of the ample annual rainfall for timely irrigation application.

The ideal locations for the water collection structures, to collect a maximum quantity of rainfall runoff, would be adjacent to the abundant low-lying bottom land. A high percentage of this low-lying bottom land is suitable for specialty crop production. Consequently, the on-farm

surface water collection structures can readily be placed in close proximity to soils suitable for specialty crop production.

Research suggests that economies of size exist in the construction of water collection structures (Dale, et al., 1986). These economies of size allow producers to reduce their per unit cost of water by building larger water collection structures. A reasonable institutional alternative to exploit the economies of size is the development of irrigation districts. It is conceivable that multi-member irrigation districts could, from one large central water structure, provide irrigation water to a group of producers at lower costs than would result from smaller, individually owned water collection structures.

An institutional incentive for the development of irrigation districts may exist in the fact that irrigation districts may be eligible for low interest state guaranteed loan funds provided by State Question 581 and related legislation (SB215, HB1710, SB145, and SB156). State Question 581, passed by voters in August 1984, enables the Oklahoma Water Resources Board to use monies in the Oklahoma Statewide Water Development Revolving Fund as security and collateral for investment certificates issued to raise funds for local entity water and sewer projects (Nelson, 1984).

The low interest funds (bond funds) are provided for any political subdivision -- county, incorporated town, municipality, school district, or irrigation district. Eligible projects include water supply reservoirs, storage tanks, water treatment and distribution systems, and wastewater treatment and collection systems (Water Resources Board, 1986).

Terms for the bond fund loans are an interest rate of 8.94 percent

with minimum and maximum payback periods of 10 and 25 years, respectively. The maximum loan amount per project for ratable entities is \$12.5 million and for non-ratable entities is \$2.5 million (Water Resources Board, 1986). These limitations are both larger than the expected requirements for small irrigation districts appropriate for specialty crop irrigation in southeastern Oklahoma.

Objectives of the Study

The overall objective of this study is to evaluate the economics of irrigated specialty crop production in southeastern Oklahoma with special consideration for the costs of developing and using surface water collection structures and associated irrigation systems. Specific objectives addressed in this thesis are as follows:

1. To estimate for a representative southeastern Oklahoma specialty crop producer, the profit maximizing crop mix, and the associated potential net return, net cash flow, size of the required water collection structure, and labor requirement; under four different acreage assumptions and two different irrigation technologies.
2. To estimate the potential economic value to a representative southeastern Oklahoma specialty crop producer of forming a multi-member irrigation district to support irrigated specialty crop

production; under four different acreage assumptions and two different irrigation technologies.

3. To estimate the potential economic value to a representative southeastern Oklahoma specialty crop producer of forming a multi-member irrigation district with low interest state guaranteed bond funds, to support irrigated specialty crop production; under four different acreage assumptions and two different irrigation technologies.

Procedures

For purposes of this study a representative southeastern Oklahoma farm and associated resources are specified. A Linear Programming model is used to evaluate the various situations. The resource base and management skills of the representative southeastern Oklahoma producer considered are assumed adequate for the production of any of the sixteen possible specialty crop enterprises -- spinach, bell peppers, seeded fall broccoli, transplanted fall broccoli, seeded spring broccoli, transplanted spring broccoli, cantaloupes, cucumbers, okra, snap beans, sweet corn, sweet potatoes, staked tomatoes, watermelons, summer squash or southern peas.

The following chapter consists of a review of selected works addressing the potential and limitations of the specialty crop industry. Chapter III is devoted to a discussion of the data used in this study.

In Chapter IV the linear programming theory used in the model is reviewed and a descriptive explanation of the actual model is presented. Results and interpretation are presented in Chapter V while conclusions and recommendations are in Chapter VI.

CHAPTER II

REVIEW OF LITERATURE

Substantial research by scientists in various institutions has resulted in considerable information about production and marketing of specialty crops. A vast majority of specialty crop research addresses both production and marketing. This characteristic is indicative of the important relationship that exists between a producer's choice of what crop to produce and information about crop marketability. Studies of the economics of both production and marketing of specialty crops are reviewed below.

Production Potential

One major concern to the entire U.S. specialty crop industry is the aggregate, nationwide consumption of specialty crops. In a study predicting the condition of the vegetable industry in the 1980's, Love (1985) noted that the per capita consumption of vegetables increased 5.0 percent between 1970 and 1983 with broccoli and cauliflower experiencing increases in consumption of 160.0 and 130.0 percent, respectively.

In addition, Love predicts the demand for vegetables will continue to increase for the remainder of this decade. Love cites population growth, age distribution, income, and taste and preference related to health and diet concerns as the major demand shifters. Thus the prospects for continued increases in specialty crop production appear

favorable.

In a recent report on the future of Oklahoma agriculture, Tweeten (1982) concluded that the potential for profitable production and marketing of vegetable crops in Oklahoma has never been better. Tweeten cited the fact that traditional production areas like California have become less competitive due to increasing costs for energy, transportation, irrigation, and other inputs. In addition, irrigable land suitable for vegetable production remains relatively inexpensive in Oklahoma.

In the report, Tweeten identified constraints and opportunities for vegetable production. Production constraints such as adequate labor, effective pest control, and current production information were cited. Tweeten pointed out that, due to the high perishability of most vegetable crops, marketing arrangements should be secured before the production season begins. Oklahoma environmental factors were also suggested as obstacles to successful vegetable production. High temperatures, strong winds, hail, water shortages, and institutional restrictions on chemicals used for pest control are all potential problems for producers. Tweeten suggested addressing these problems through a complete research program combined with extension and teaching programs.

Sleper et al. (1984) summarized the agronomic and climatic factors related to specialty crop production for Atoka county in southeastern Oklahoma. Soils considered suitable for specialty crop production are sandy loam with less than five percent slope and good drainage. In Atoka county, 95,000 acres are suitable for production of specialty crops. Sleper et al. found that based on temperature and precipitation,

various specialty crops could be successfully produced in Atoka county for a period of eight months. However, due to the irregular rainfall, especially during the summer, the need for irrigation was cited.

Market windows for specialty crops were also identified by Sleper et al. A market window was defined as when product volume is low and prices are high. Wholesale market price data from St. Louis, Chicago, and Dallas were studied for possible market windows. A price difference of 10.0 to 30.0 percent was defined as a mild window, 31.0 to 65.0 percent price difference was considered a moderate window, and a price difference greater than 65.0 percent was considered a strong window.

With the information derived from the research, Sleper et al. made recommendations about the optimal vegetable enterprise and market combination for Atoka county specialty crop producers. Crops were judged primary, secondary and other. A primary classification was given to crops which hold the most potential for production and marketing in southeastern Oklahoma. A secondary classification was designated for crops with moderate potential. Crops with the least amount of promise were classified as other. Some crops on the primary list include asparagus, spring and fall broccoli, cucumbers, sweet potatoes, and spinach.

Existing producers involved in traditional agricultural enterprises may find it beneficial to supplement their existing farm plans with some non-traditional enterprises. Wickwire (1985) attempted to estimate the possible increases in incomes associated with the addition of specialty crop enterprises to traditional farm plans for producers in Atoka and Bryan counties. Traditional farm plan production data was incorporated into a linear programming model with an assumed farm resource base. The

farm base included a one hundred head cow/calf herd, twenty-two acres of quota peanuts, and seventy-eight acres of wheat for grain.

Wickwire's estimated net returns for the traditional enterprises were compared to the net returns experienced when twenty acres of wheat land was converted to specialty crop production. Estimated net returns were increased 55,326 dollars by the conversion. The optimal specialty crop mix included fall broccoli, cucumbers, tomatoes, and spring broccoli.

Wickwire also considered a fifteen percent decrease in specialty crops prices. The optimal enterprise mix was fall and spring broccoli, cucumbers, and tomatoes. A fifteen percent reduction in specialty crop prices resulted in an estimated twenty-five percent reduction in net returns.

Estes (1985) addressed the advisability of tobacco, peanut, and dairy producers in the southeastern United States turning to horticultural enterprises to offset reductions in net incomes due to changes in farm programs. Estes found good potential for dramatic increases in specialty crop production but recommended caution due to unstable commodity prices, high production risks, and an inability to secure assured market outlets.

Estes pointed out that the capability of growing a fruit or vegetable crop should not be confused with the ability to successfully market the crop at a price sufficient to cover costs. As the production of specialty crops increases, producers must seek regional and national outlets for their products and face an increasingly elastic demand curve. With increased production, producers who sell to local markets will do so at substantially lower prices than they would receive before

the increase in specialty crop production. Therefore, any increased production of specialty crops must be accompanied by increased regional and national marketing efforts. Also, producers should consider temporal demand constraints and expected price levels during appropriate harvest periods in order to evaluate the profitability of specialty crops.

Estes concluded by citing the following factors as limitations on increased production in the south: 1) modest growth in consumption of specialty crops, 2) the ability of southern producers to substitute local production for current supply sources, 3) perishability of specialty crops prohibiting storage, 4) seasonality of production and consumption patterns, and 5) current organizational structures of production and marketing systems. In addition, risk, variability in prices and incomes, and substantial investment costs affect the profit potential for specialty crops.

Market Potential

Collete and Wall (1978) evaluated the advisability of limited resource farmers in Florida attempting to synchronize their vegetable production with market windows indicated in Atlanta wholesale market price information. Three factors were considered in evaluating the feasibility of producing cucumbers, eggplants, peppers, and tomatoes for market windows; 1) the length of the market window, 2) relative price variability of the various crops, 3) the price-quantity flexibility for area production. These factors relied heavily on physiology, climate and cultural conditions.

Collete and Wall classified the crops considered from most stable to most variable as eggplant, tomatoes, cucumbers, and peppers. They

conclude by stating that the advisability of fresh market vegetable production for increasing welfare of limited resource producers should be weighed against the risks associated with the price variability of the markets.

Tilley et al. (1984a) attempted to provide preliminary conclusions and a preliminary plan for vegetable marketing alternatives for southeastern Oklahoma. Findings in Tilley et al., indicated that due to recent historical decreases in canned good consumption and the fact that a large portion of recent increases in frozen consumption was in processed potatoes -- a product not readily adapted to southeastern Oklahoma -- fresh market vegetables are the best choice for southeastern Oklahoma producers.

Tilley et al. (1984b) provided a summary of marketing alternatives for Oklahoma specialty crop producers. Direct Market alternatives such as pick-your-own, roadside markets, and farmers' markets were discussed. Nondirect outlets such as terminal wholesale markets, cooperative and private packing facilities, and restaurants and grocery stores were also addressed. Characteristics such as harvesting and transportation costs, selling costs, grower liability, and quality were provided for each of the respective marketing alternatives. This information was designed to aid producers in deciding which marketing alternative was best suited to their probable production situation.

Vitelli et al. (1982) summarized vegetable and fruit production and marketing potential in the South (Alabama, Florida, Georgia, Louisiana, Mississippi, Arkansas, S. Carolina, and North Carolina). Objectives were to present information on 1) potentials for expanding production from current levels and 2) coordinating crops best suited for each type

of potential market. The authors concluded that the fruit and vegetable sector of the economy is faced with major adjustments to compensate for economic and institutional changes, technological innovations, and changes in consumers' preferences.

Vitelli et al. evaluated the potential for increased marketing through direct marketing options. Potential for increased direct marketing in roadside stands and pick-your-own operations was identified for fruits, while roadside markets appear to hold promise for vegetable producers.

Also, Vitelli et al. predicted the potential for increased regional or national marketing to be high. However, this type of marketing requires that the product have a lengthy 'shelf life' to survive the longer transportation periods. Processing alternatives were the only type of marketing alternative for fruits and vegetables that was predicted to be low.

CHAPTER III

ANALYTICAL PROCEDURES AND DATA

Analytical Procedures

This section includes a description of the analytical procedures used to address the objectives, the necessary data, and related resource assumptions. Three scenarios are developed to analyze the objectives.

Scenario one addresses the costs for a representative producer developing on-farm surface water resources and the appropriate irrigation system. Profit maximizing crop mixes and associated economic costs, net returns, cash flows and labor requirements are estimated for a representative specialty crop producer in southeastern Oklahoma.

Scenario two addresses the benefits accruing to the same representative producer from participating in a multi-member (6 members) irrigation district. The potential economic value of irrigation district development to a representative group of specialty crop producers in southeastern Oklahoma is measured by comparing estimated costs, net returns, cash flows, and labor requirements for a producer belonging to an irrigation district with estimates generated in scenario one.

Scenario three addresses the benefits accruing to the same irrigation district situation described in scenario two from financing with low interest state guaranteed funds designed for water and sewer projects. The potential economic value of bond funds to the

representative specialty crop producer in southeastern Oklahoma is measured by comparing estimated costs, net returns, cash flows, and labor requirements for a producer belonging to an irrigation district which avails itself of the low interest funds with estimates generated in scenario two with conventional financing.

Four acreages (1.0, 2.5, 5.0, and 10.0 acres) and two irrigation technologies (furrow and handmove surface) are analyzed for each of the three scenarios.

A linear programming model developed by Wickwire is modified and used to analyze the scenarios. Modifications to the model include the removal of all non-vegetable enterprise activities and the inclusion of separable variables representing the annual fixed cost and cash flow requirements for building the complete irrigation system (structure, pump, motor, and distribution system).

The initial step in the analysis was to approximate a cost curve for the water collection structures suitable for specialty crop irrigation in southeastern Oklahoma. Costs for eighteen collection structures are estimated in accordance with the method detailed below. This nonlinear declining curve relates dollars to acre inches of water.

The cost curve is incorporated into the linear programming model by using separable variables to represent the annual debt service and fixed cost associated with the incremental quantity of water supplied by the increasingly larger irrigation systems. A cost curve was estimated for each of the three scenarios hypothesized in the study.

For the individual producer scenarios and for the irrigation district scenarios, an annual interest rate of 12 percent and a payback period of 7 years is assumed for calculating capital costs for the

complete irrigation system (structure, pump, motor, and distribution system). For the bond fund scenarios, the program interest rate of 8.94 percent is used with an assumed payback period of twenty five years -- the maximum eligible under the the program.

Data Requirements and Resource Assumptions

Land and basic farm equipment are assumed owned. A minor investment expense may be required for a two-row transplanter and/or a soil bedder for certain crops. The expense incurred by the purchase of these items is negligible.

The available land resource in the model is limited to the amounts available for vegetable production. However, due to cultural and disease problems many vegetable crops must be rotated regularly. Therefore, it is reasonable to assume that the specified acreage is rotated between plantings and/or growing seasons over a larger parcel of land. That is, a producer may own say, 20 acres of land suitable for vegetable production, and rotate the smaller acreage actually in vegetable production over this twenty acres.

Many specialty crop varieties are well adapted to the climatic and agronomic conditions of southeastern Oklahoma. Information about the crop mixes considered and the production practices for the individual crops was obtained from Oklahoma State University horticulturist (Motes, 1985). The most important criteria for selecting varieties is whether or not the variety is one accepted by the buyer (Tilley and Schatzer, 1985).

Production data makes up a large portion of the data requirements. Production data including fertilizer, pesticides, seed, and harvesting

TABLE II
SPINACH BUDGET

SPRING SPINACH, OKLAHOMA SANDY LOAM SOILS, IRRIGATED, OWNED EQUIPMENT WITH HAND HARVEST BUSHEL BASKETS, ADJ. DALLAS WHOLESALE PRICE.					
OPERATING INPUTS:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
HERB RO-NEET 6E	ACRE	23.000	1.000	23.00	
15-15-15 FERT.	CWT.	9.750	4.000	39.00	
RNT FERTSPRD/ACRE	ACRE	1.250	2.000	2.50	
SEED	LBS.	1.900	10.000	19.00	
PEST CYGON	ACRE	5.000	1.000	5.00	
PEST LANNATE 1.8	ACRE	12.150	2.000	24.30	
FUNG MANZATE 200	ACRE	4.220	3.000	12.66	
NITROGEN (N)	LBS.	0.220	100.000	22.00	
BASKETS	BU.	1.020	400.000	408.00	
HAND HARVESTING	HR.	4.650	200.000	930.00	
GRADING & MKTG	BU.	1.200	400.000	480.00	
ANNUAL OPERATING CAPITAL	DOL.	0.130	15.990	2.08	
LABOR CHARGES	HR.	4.881	8.427	41.13	
MACHINERY FUEL, LUBE, REPAIRS	ACRE			24.48	
IRRIGATION FUEL, LUBE, REPAIRS	ACRE			4.95	
TOTAL OPERATING COST				2038.10	
FIXED COSTS			VALUE	YOUR VALUE	
MACHINERY					
INTEREST AT 13.0%	DOL.	69.839			
DEPR., TAXES, INSUR.	DOL.	92.955			
IRRIGATION					
INTEREST AT 13.0%	DOL.	22.800			
DEPR., TAXES, INSUR.	DOL.	18.600			
LAND					
INTEREST AT 0.0%	DOL.	0.000			
TAXES	DOL.	0.000			
TOTAL FIXED COSTS		204.19			
PRODUCTION:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
SPINACH	BU.	7.650	400.000	3060.00	
RETURNS ABOVE TOTAL OPERATING COSTS				1021.90	
RETURNS ABOVE ALL COSTS EXCEPT OVERHEAD, RISK AND MANAGEMENT				817.71	
MANZATE 1.5 LB. AI; RO-NEET 3 LBS. AI; CYGON 4 OZ. AI; LANNATE .5 LB AI; SIDEDRESS 295 LBS. 34-0-0 FERT. LESALE PRICE.					
				WICKWIRE, SCHATZER NOTES	
PROCESSED BY DEPT. OF AGRI. ECON. - OKLAHOMA STATE UNIVERSITY PROGRAM DEVELOPED BY DEPT. OF AGRI. ECON. OKLAHOMA STATE UNIVERSITY					

cost, used in this study are based on specialty crop enterprise budgets developed by Wickwire, Schatzer, and Motes. An enterprise budget for spring spinach is shown in Table II. The Appendix consist of an enterprise budget for each of the 16 other specialty crop activities considered in this study.

Budget information is used to develop the vegetable activities in the model. As discussed in the description of the model tableau in Chapter IV, vegetable activities produce yield which is sold by selling activities and require labor, water and operating capital which is supplied by purchasing activities. Since it is assumed that the aggregate machinery fixed costs do not change, these values are not included in the model, except for irrigation. The objective function value for spinach is therefore the total operating cost less labor charges, annual operating capital charges, and irrigation fuel, lube, and repair charges.

An unlimited quantity of labor is assumed available at a price of 5.00 dollars per hour rather than the 4.65 dollars shown in the budget. All labor is assumed hired and perfect in mobility. If all labor is provided by the farm family, this assumption means the family is paying itself 5.00 dollars per hour.

It is assumed the producer may borrow up to 300.00 dollars of operating capital per acre at an annual interest rate of fifteen percent. In many instances, after the first specialty crop harvest, the operating capital requirements would be met by revenues generated by product sales.

Fertilizer applications are based on recommendations (Campbell, 1980). A commercially mixed fertilizer of fifteen percent nitrogen,

fifteen percent phosphate, and fifteen percent potash, triple 15, works well in southeastern Oklahoma. Any additional nitrogen fertilizer applications are assumed to be ammonium nitrate -- 30-0-0. For spinach production 400.0 pounds of triple 15 and 100.0 pounds of nitrogen are used.

Pesticides play a necessary role in the modern production of agricultural commodities. Herbicides, insecticides, fungicides, nematocides, and bactericides are essential for adequate quantity and quality of specialty crops. The requirements differ yearly according to insects, soils, climate, and crops. Average recommendations for expected conditions are used. The specific chemicals used in the production of spinach are shown in the spinach budget.

Harvesting and marketing costs are substantial contributors to the costs of production of specialty crops. Also, post-harvesting expenses like cooling, packaging, washing, and transportation increase production costs for producers. Transportation costs vary greatly depending on freight supply and demand. During the off-season, truckers usually attempt to cover only their operating costs, but during periods of high demand may charge as much as double their usual rate (Sleper et al., 1984). Assumed harvesting and marketing costs are shown in the budgets.

Data was also obtained on construction costs of water collection structures. Technical information used to estimate the cost and physical parameters for the water collection structures appropriate for the areas irrigated, was obtained from Oklahoma state water resource specialists with the Soil Conservation Service, United States Department of Agriculture (SCS). The data supplied by the SCS considered a variety of rainfall levels as well as evaporation to maintain an average depth

of eight feet.

Cost information (costs of soil moved, cover establishment, necessary pipe requirements, etc.) for developing such structures was obtained from the Oklahoma state office of the Agricultural Stabilization and Conservation Service, United States Department of Agriculture.

To obtain the construction costs of the water collection structures, the total number of yards of soil moved for a desired acre inch capacity is calculated. This value is multiplied by the expected cost per yard for soil moved (0.70 dollars).

Total area (structure surface area plus a thirty foot spoil area) is then calculated. By subtracting the structure surface area from the total area value, the area of the spoilage requiring cover is calculated. This spoilage area times the price per acre of cover (116.00 dollars), equals the total cover cost. Also, the perimeter of the total area is calculated. By multiplying the perimeter value by the price of fencing per foot, (0.46 dollars), a total fencing cost is obtained.

The summation of the total cost of soil moved, fence cost, cover cost, and an additional drainage pipe cost of 576.00 dollars (the cost of the required quantity of eight inch metal corrugated drainage pipe), yields a total cost of construction for a structure. Maintenance cost for the cover, structure, and fence are assumed negligible.

Figure 2 depicts the layout of the irrigation system for the individual producer scenarios. For the irrigation districts, the layout depicted in Figure 3 is assumed. For the individual producer scenarios, 200 feet of above ground main line was assumed to run from the water

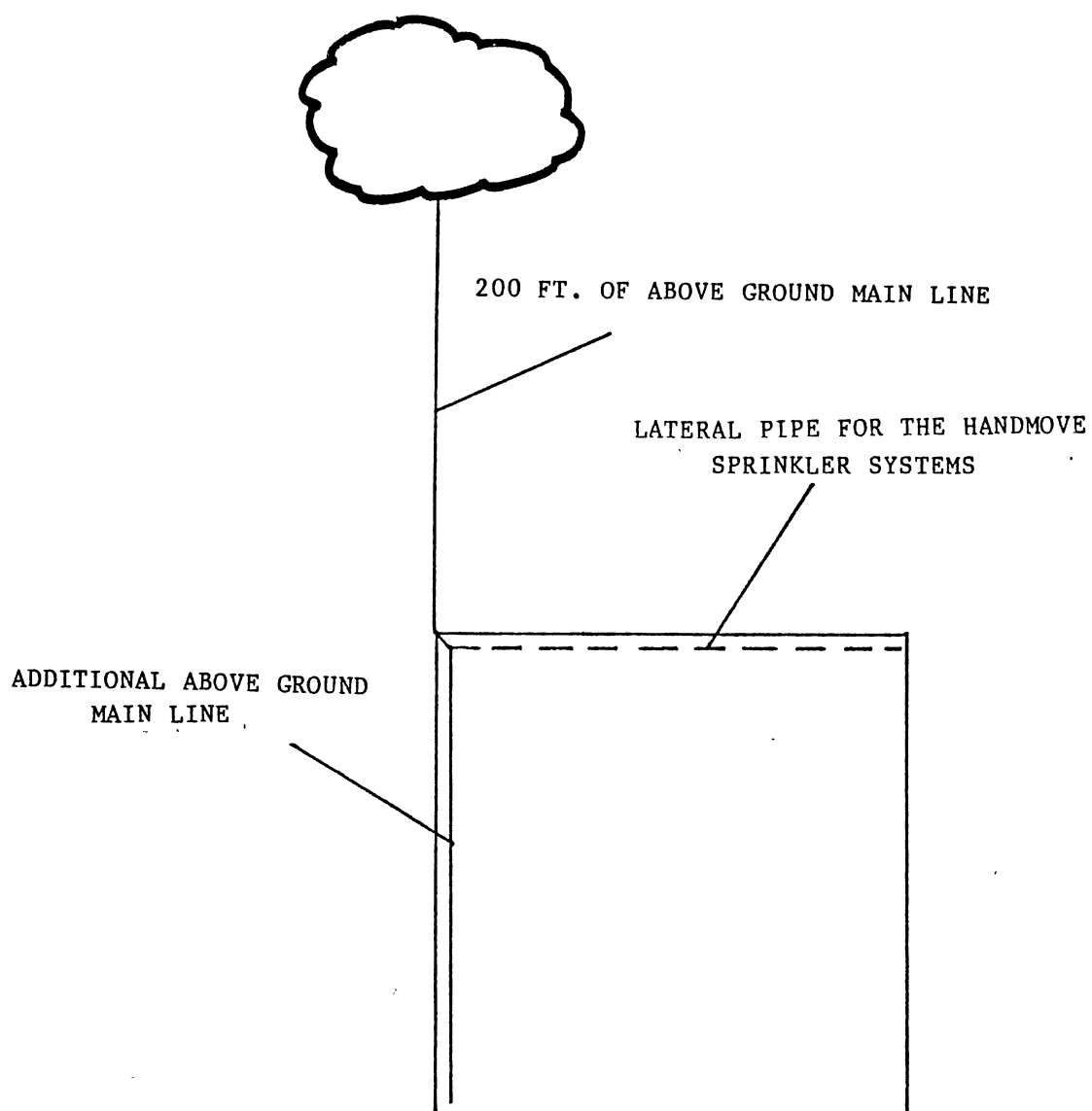


Figure 2. Assumed Individual Producer Irrigation
System Layout

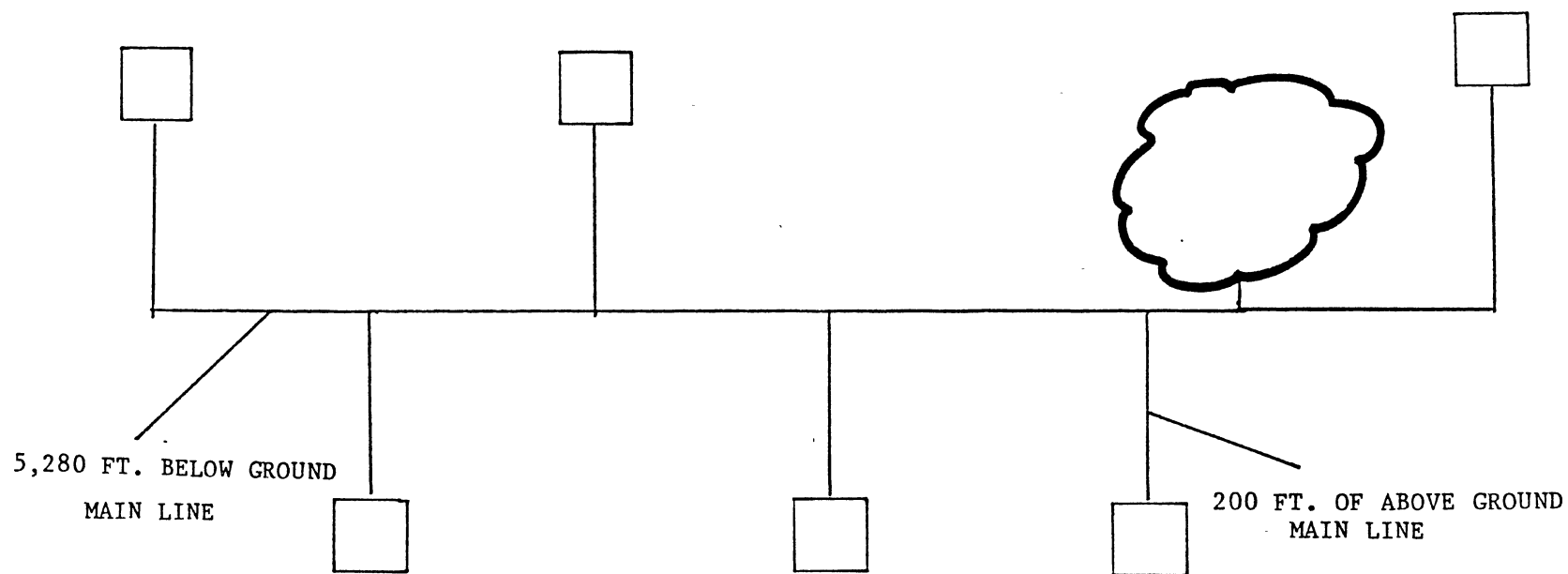


Figure 3. Assumed Irrigation District Layout

collection structure to the vegetable acreage. For the furrow systems, the main line leading from the structure is connected to a length of main line pipe running the length of the respective acreages and applies water directly to the crops from this pipe.

For the handmove scenarios, a perpendicular segment of lateral pipe lateral is moved along the main line and water applied accordingly.

For the irrigation district a segment of below ground main line pipe extends a total of 5,280 feet. This main line serves six members through six 200 foot segments of above ground main line pipe. The layout of the systems on the plot are identical to the individual producer assumptions depicted in Figure 2.

It should be noted that the distances assumed are simply for purpose of analysis and the distances may, in reality, vary depending on individual cases. The purpose was to successfully estimate with relative accuracy the size and cost of the irrigation systems. The specific distances are of less importance than the total, relative costs.

Non-structure related irrigation capital and operating costs were estimated by using the O.S.U Irrigation Cost Generator (Kletke and Mapp, 1978). The Irrigation Cost Generator is a computer program which calculates cost information, both fixed and variable, on a per acre-inch and per acre basis. Estimates can be made with various assumptions regarding the irrigation well, fuel source, distribution system, and water requirements. Many, if not most, irrigation situations can be simulated by specifying key variables accordingly. Data taken from the Irrigation Cost Generator output include labor requirements, fixed costs, and variable costs for the pump, motor, and the distribution

system. The application efficiency for the irrigation technology is assumed to be 80.0 and 60.0 percent for handmove sprinkler and furrow irrigation, respectively (Wade, 1986). An example of the Irrigation Cost Generator output is provided in Table III.

Net Returns

Considerable price variation exists in specialty crop markets. Wickwire (1985) attempted to address the net returns risk by implementing a coefficient of variation (CV) measure. The CV measure is a unitless measure of the variation of price, yield, and input costs as it affects net returns. The higher the CV value a crop has, the higher production risk associated with the crop. The results of Wickwire's analysis indicated spring broccoli and cucumbers to be high risk crops. Fall broccoli, cantaloupes, sweet potatoes, sweet corn, watermelons, snap beans, tomatoes, and bell peppers were found to be medium risk, and okra was determined to possess little risk.

For purposes of this study, product prices were determined from six years of weekly historical data from the Dallas, Texas Wholesale Produce Market for top quality produce. It is assumed that growers will receive Dallas Wholesale prices, less a fifteen percent brokerage fee, less the marketing and grading costs for the respective crops. The assumed weekly prices are shown in Table IV.

Crop yields used in this study are based on research data and discussions with established producers in the state. Yield distributions are assumed fixed in this study. These yields may vary depending on 1) management skills of operators; 2) planting dates; 3) harvesting dates; and 4) growing conditions and cultural practices.

TABLE III
IRRIGATION COST GENERATOR SAMPLE OUTPUT

OKLAHOMA STATE UNIVERSITY IRRIGATION COST PROGRAM									
SURFACE SYSTEM									
SYSTEM REQUIREMENTS CHARACTERISTICS AND COSTS									
THE FARM									
ACRES COVERED:	1 0	GALLONS PER MINUTE:	40.	INCHES PER ACRE:	20.00				
ANNUAL HOURS USE:	226.2	PRESSURE/50 IN AT DISCHARGE:	15.00	ACRE INCHES PER YEAR:	20.00				
		TOTAL DYNAMIC HEAD:	38 66	ACRE INCHES PER SET:	1.00				
THE WELL									
WELL DEPTH:	8.0	DEPTH TO WATER LEVEL:	4 0	COST/FOOT DRILL & DEVL.:	474.96				
THE PUMP									
DEPTH SETTING COL. PIPE:	6.	NUMBER OF BOWLS SET:	1	PIPE DIAMETER:	8 000				
IF 1, EXTRA 10 FT SECTION:	1	COST PER BOWL:	650 00	TUBE DIAMETER:	2.000				
# OF 20 FT COLUMN SECT :	0	SECONDARY BOWL COST:	150 00	SHAFT DIAMETER:	1.250				
PRICE PER 20 FT SECTION:	688.00	TOTAL COST OF BOWLS:	800 00	GEARHEAD COST:	864 00				
PUMP EFFICIENCY:	0.750	STRAINER COST:	61 00	PUMPBASE COST:	1238 00				
DRIVE EFFICIENCY:	1.000	SUCTION COST:	106.00	TOTAL PUMP COST:	3669.40				
THE ENGINE									
ELECTRIC ENGINE		ENGINE COST:	1700 00	BRAKE HORSEPOWER REQUIRED:	0.52				
ELECTRIC FUEL:		FUEL COST PER UNIT:	0.050	WATER HORSEPOWER:	0.39				
		ALTITUDE:	585	PURCHASE HORSEPOWER NEEDED:	0.52				
HOURS OF ENGINE LIFE:	50000.	AVERAGE MAXIMUM TEMPERATURE:	90 0	PURCHASE HORSEPOWER USED:	20.00				
THE DISTRIBUTION SYSTEM									
SECTION ONE		SECTION TWO		SECTION THREE		SECTION FOUR			
MAIN LINE ABOVE GROUND		LATERAL							
FEET:	200 00	FEET:	208 71	FEET:	208 71	FEET:	0 00		
TYPE PIPE:	ALUMINUM	TYPE PIPE:	ALUMINUM	TYPE PIPE:	ALUMINUM	TYPE PIPE:			
DIAMETER:	8 00	DIAMETER:	8 00	DIAMETER:	8 00	DIAMETER:	0 00		
COST/FOOT:	3 20	COST/FOOT:	3.20	COST/FOOT:	4 80	COST/FOOT:	0 00		
NUMBER LINES:	1	NUMBER LINES:	1	NUMBER LINES:	6.	NUMBER LINES:	1		
BELOW GROUND VALVES:	0.	ABOVE GROUND VALVES:	1.	LATERAL PIPE COST:	667 87	MAINLINE COST:	640.00		
COST BELOW GR. VALVES:	30 10	COST ABOVE GR. VALVES:	25 75	TOTAL VALVE COST:	25.75	DISTANCE BETWEEN SETS:	200		
THE PARAMETERS									
INTEREST RATE:	0.150	LABOR COST PER HOUR:	5 00	TAX RATE:	0.010				
INSURANCE RATE:	0.005	COST/GAL OIL OR GREASE:	5.00	WELL TAX PER GALLON:	0 000				
YEARS OF WELL LIFE:	20.	YEARS OF COLUMN LIFE:	16.	TAX ASSESSMENT RATE:	0.200				
YEARS OF BOWL LIFE:	8.	YEARS OF GEARHEAD LIFE:	15.						
THE PER ACRE INCH COST SUMMARY									
FIXED COSTS					INVESTMENT COSTS				
DEPRECIATION		TAXES	INSURANCE	INTEREST	TOTAL/ACIN	TOTAL/ACRE	TOTAL/YEAR		
WELL	9.50	0 00	0 00	14 25	23 75	474 96	474 96	3799.68	
PUMP	9.76	0 37	0.92	13 76	24 80	496.02	496.02	3669.40	
MOTOR	0.38	0.17	0.42	6 37	7 35	147 09	147.09	1700.00	
SYSTEMS	4.45	0.13	0.17	5 00	9 75	194 93	194 93	1333.62	
TOTALS	24.09	0.67	1.51	39.39	65.65	1313.00	1313.00	10502.70	
VARIABLE COSTS									
FUEL		LUBRICANTS	REPAIRS	LABOR	TOTAL/ACIN	TOTAL/ACRE	TOTAL/YEAR		
WELL	0.00	0.00	0 00	0 00	0 00	0 00	0 00		
PUMP	0.00	0.00	0.69	0 00	0.69	13 84	13.84		
MOTOR	0.25	0.04	0.29	1 70	2 27	45 45	45 45		
SYSTEMS	0.00	0.00	0.15	2 45	2 60	52.02	52 02		
TOTALS	0.25	0.04	1.13	4 15	5.57	111 31	111.31		
COMPLETE TOTALS					71.22	1424.31	1424 31		

TABLE IV

AVERAGE WEEKLY PRODUCT PRICES FOR SELECTED VEGETABLE ENTERPRISES

[illegible]

Beginning growers should not depend on obtaining these yields or prices for their crops until they gain experience in the production and marketing of specialty crops.

Net returns of farm production are a function of inputs, prices, and costs. Net returns, in this study, are a return to land, management, and other non-irrigation related capital investments such as machinery and improvements. New commercial specialty crop producers should expect their revenues to fall somewhat short of the predicted values in this study. These estimates assume perfect conditions with no risk and adequate resources for the optimal production levels. Ending cash flow, in this study, is the cash flow available at the end of the year after paying all operating cost (including all labor at 5.00 dollars per hour and all borrowed operating capital at 15.0 percent interest) and the principal and interest payment on the irrigation system.

CHAPTER IV

DEVELOPMENT OF THE MODEL

Linear Programming Theory

Linear Programming provides a means of dealing with the allocation of limited resources to competing activities. It is the objective of linear programming to minimize or maximize an objective function. The following equations represent the general linear programming model.

$$\text{Max. (Min.) } Z = \sum_{j=1}^n C_j X_j \quad (4.1)$$

$$\text{subject to } \sum_{j=1}^n a_{ij} X_j \leq b_i \quad (4.2)$$

$$X_j \geq 0 \quad (4.3)$$

where

a_i = the required quantity of the i 'th resource used for the j 'th activity,

C_j = the per unit revenue of the j 'th activity,

X_j = level of the j 'th activity,

b_i = the given level of the i 'th resource,

$Z = \sum C_j X_j$ = the objective function.

The following basic assumptions must be adhered to for linear programming to be valid:

1. Additivity of resources and activities. The sum of resources used by different activities must equal the total quantity of resources used by each activity for all the resources, individually and collectively. No interaction between the activities exists.
2. Linearity of the objective function. Product prices are not a function of the quantity sold. In essence, constant marginal physical product is assumed.
3. Nonnegativity of the decision variables. negative quantities of inputs or negative levels of an activity are not valid.
4. Divisibility of activities and resources. Continuity of resources is assumed, that is, fractional quantities of resources and inputs are valid.
5. Finiteness of the activities and resources restrictions. A finite number of alternative activities and resource constraints must be present to allow the calculation of an optimal solution.
6. Proportionality of activity levels to resources. Proportionality assumes linear relationships between activities and resources

and implies constant resource productivity and constant returns to scale.

7. Single-valued expectations. Resource supplies, input output coefficients, and prices of resources and activities, are known with certainty.

These above mentioned assumptions prevent the use of linear programming from solving many real life problems. The development of several extensions to linear programming have made it possible to relax one or more of the basic assumptions and calculate valid and reliable solutions. Integer programming is an example of an extension to the basic linear programming model.

Development of the Model

Many times, researchers are faced with nonlinear relationships. Non-Linear programming allows the assumption of linear objective functions and resource constraints to be relaxed. The nonlinear, declining irrigation development cost curve estimated in this research necessitates the use of a nonlinear programming method.

A cost curve for the irrigation development alternatives considered in this study was estimated as discussed in Chapter III. Such a curve, $f(W_1)$, relates cost in dollars to acre inches of water. The curve shows a declining marginal cost which indicates the per unit cost of water declines as size increase. To include the nonlinear function in the objective function of the linear programming model, the following adjustments were made:

$$\text{Max. } Z = \sum_{j=1}^n C_j X_j - \sum_{j=1}^n f(w_j) \quad (4.4)$$

$$\text{subject to } \sum_{j=1}^n a_{ij} X_j \leq b_i, \quad (4.5)$$

$$X_j \geq 0; w_j \geq 0. \quad (4.6)$$

where

a_i = the required quantity of the i 'th resource used for the j 'th activity,

C_j = the per unit revenue of the j 'th activity,

X_j = level of the j 'th activity,

b_i = the given level of the i 'th resource,

$Z = \sum C_j X_j$ = the objective function.

$f(w_j)$ = nonlinear relationship approximating the cost curve for the water collection structures,

w_j = water demanded by the j 'th activity.

Therefore, with the addition of the nonlinear function representing the irrigation system costs, the model is designed to maximize net returns to land, management, and other non-irrigation capital investments.

The model consists of rows which are either resources constrained in the study or transfer rows which provide a mechanism to transfer a good or service from one activity to another.

The model has columns consisting of all planting, borrowing, hiring, and selling activities. Included in these columns are separable activities representing the nonlinear cost curves for irrigation

development. Also columns exist for cash flow and water transfer. Column activity parameters represent the quantity of the respective resources required by the activity. Table V provides a partial tableau of the model

The first columns in Table V are the spinach production activities for each week spinach can be planted. In the objective function row is a negative value for total variable cost -- less labor, irrigation, and operating capital costs (adjusted variable cost) -- for one acre of spinach. In the remainder of the rows are the requirements of one acre of spinach for each respective resource. In the cash flow rows, for the weeks spinach requires cash, there is a positive coefficient equal to the adjusted variable costs for the week for one acre of spinach. The next rows are yield rows which contain a negative yield amount for spinach in each week of harvest. While spinach is assumed harvested in only one week, some of the other crops can be harvested in multiple weeks. The next rows allow for any spinach labor requirements to be purchased through labor purchasing activities for 5.00 dollars an hour in the week of need. Finally, land rows contain a positive one for each week spinach requires land from seedbed preparation to end of harvest. The water rows allow water to be supplied to the spinach production activities through the water buy activities.

The next columns represent the labor hire activities. The objective value is the negative price of labor (5.00 dollars per hour). In the week that labor is purchased the positive price of labor is entered in the cash flow rows. Also a negative one is present in the labor supply row for the week that labor is supplied by the activity.

Selling activities contain a positive price for spinach that

TABLE V
PARTIAL TABLEAU OF THE LINEAR PROGRAMMING MODEL

ROW NAMES	Spinach... Week 4	Spinach... Week 14	Hire... Week 1	Hire... Week 52	Sell... Week 14	Sell... Week 24
Objective	-b	-b	-5.00	-5.00	6.87	a 7.01
Cash Flow Week 1	a	a	5.00			
Cash Flow Week 2	a	a		e		
Cash Flow Week 3	a	a		e		
Cash Flow Week 4	a	a		e		
...	a	a		e		
Cash Flow Week 14	a	a		e	-6.87	
...	a	a		e		b
Cash Flow Week 16	a	a		e		-7.01
...	a	a		e		
Cash Flow Week 49	a	a		e		
...	a	a		e		
Cash Flow Week 52	a	a		5.00		
Capital Week 4						
Capital Week 8						
...						
Capital Week 48						
Capital Week 52						
Yield Spinach 14	-y				1	
...		-y				1
Yield Spinach 16			-y			1
Labor Week 1	a	a	a	-1		
Labor Week 2	a	a	a	-c		
...	a	a	a	-c		
Labor Week 51	a	a	a	-c		
Labor Week 52	a	a	a	-1		
Land Week 1						
...						
Land Week 4	1					
...	1	c				
Land Week 14	1	1	1			
...		c	c			
Land Week 52						
Water Week 1	a	a	a			
...	a	a	a			
Water Week 52	a	a	a			
Water Supply						

a is a positive coefficient or zero, c is a positive one or zero
b is a negative coefficient or zero, d is a negative, positive, or zero coefficient

TABLE V. (continued)

Transfer Cash Flow... Week 1 to Week 2	Transfer Cash Flow... Week 51 to Week 52	Borrow Cash Flow... Week 1 Payback Week 4	Borrow Cash Flow... Week 1 Payback Week 52	Borrow Cash Flow... Week 49 Payback Week 52
.001		-0.0115 b	-0.15 b	-0.0115
1		-1	-1	
-1.001	d			
	d			
	d	1.0115		
	d	a		a
	d	a		a
	d	a		a
	d	a		a
	d	a		a
	d	a		a -1
	d	a		a
	-1.001		1.15	1.0115
		1	1	
		c	1	c
		c	1	c
		c	1	c
			1	c 1

e is 5.00 or zero, y is the yield for the activity
A is the acreage assumed in the respective scenario

TABLE V. (continued)

Buy Water... Week 1	Buy Water Week 52	Irrigation System Build 1	Irrigation System Build 18	Row Type	Right Hand Side
-b	-b	-b	-b	L	
b	e			L	0
	e			L	0
	e			L	0
	e			L	0
	b			L	0
				L	0
				L	0
				L	0
				L	0
				L	0
		b	b	L	0
				L	300.00 dollars * A
				L	300.00 dollars * A
				L	300.00 dollars * A
				L	300.00 dollars * A
				L	300.00 dollars * A
				L	0
				L	0
				L	0
				L	0
				L	0
				L	0
				L	A
				L	A
				L	A
				L	A
				L	A
				L	A
				L	A
-1				L	0
	-c			L	0
		-1		L	0
1	1	1	-1	L	0

1 is the incremental acre inches of water supplied by the respective separable activities, ... denotes rows omitted for weeks or combinations of weeks

contributes to the objective function. Prices for the specialty crops vary during the harvest period. In the cash flow rows, for the week the activity is selling spinach, there is a value equal to the weeks' spinach price which contributes to cash flow. Furthermore, a positive one occurs in the spinach yield row for the week.

Transfer cash flow activities transfer cash flow from week to week. Positive cash flow transfer has been designed to create interest income from week to week equal to the return on typical passbook savings (5.25 percent per annum).

The operating capital borrowing activities provide means to borrow operating capital. The objective value is the negative interest charge depending on how long the operating capital is borrowed. Operating capital may be borrowed in four week periods. In the capital rows a positive one represents the borrowing of one dollar.

The last columns are the irrigation development activities. These activities build the irrigation systems, and transfer water to the water row. An acre inch of water is provided to the crops through the water buy activities.

The final two columns are the row type column which indicates the constraint type and the right-hand-side (RHS) column which contains resource levels for the model. In the RHS column, land is limited to the amounts specified in Chapter I for each scenario, and total operating capital borrowed is limited to 300.00 dollars per acre.

CHAPTER V

RESULTS AND COMPARISON OF SCENARIOS

The compilation of data from sources discussed in Chapter III allows identification of an objective function, resource bases, activity limits, and product prices for alternative southeastern Oklahoma specialty crop production scenarios. Using the linear programming Mathematical Programming Solutions Extended (MPSX) algorithm, returns to land, management, and non-irrigation related capital investment cost for machinery and improvements were maximized. MPSX output, which includes estimates of net returns, ending cash flow, labor requirements, and operating capital requirements, were used to evaluate the alternative farm plans hypothesized in this study.

Ending cash flow represents the total annual cash available to the producer for living expenses and non-vegetable production related cash outflows. The ending cash flow estimate is recommended as a more accurate measure of net benefit accruing to a producer than is the net returns estimate. With the everyday cash inflows and outflows incorporated into the ending cash flow, the ending cash flow value more accurately depicts the "real life" situation the producer is facing.

Labor requirements are given in forty hour units and are constant across size and irrigation technology. If part of the labor is supplied by the family, the savings increase the cash available for living expenses. Investment costs provided are for the complete irrigation

system (structure, pump, motor, and distribution system). The operating capital requirements are the maximum capital needs in addition to the sales revenue necessary to maintain the farm operation. This capital is needed for only a short period of time, not the entire year. For all situations, the profit maximizing crop mix was found to be spring spinach, cucumbers, and fall broccoli.

Scenario One

This scenario addresses the economics of irrigated specialty crop production for an individual specialty crop producer involved in no special institutional arrangements. The producer pays all costs of the complete, on-farm irrigation system (structure, pump, motor, and distribution system). Estimates were made for the four different acreage assumptions, and the two different irrigation systems.

For the hypothesized one acre, handmove system operation, net returns were 1,620 dollars, ending cash flow was 697.00 dollars, and the operating capital required was 228.00 dollars. To provide adequate water for irrigation, it is necessary to construct a surface water collection structure with approximately 12.25 acres of surface area holding 16.89 acre feet of water. The total investment cost of the complete irrigation system is 9,108 dollars. Results for scenario one are provided in Tables VI and VII.

Scenario Two

Scenario two was designed to estimate the potential economic impact on an individual producer of the development of a multi-member irrigation district to provide irrigation water to district members.

TABLE VI
NET RETURNS, ENDING CASH FLOW, AND
OPERATING CAPITAL FOR
SCENARIO ONE

	NET RETURNS	CASH FLOW	OPERATING CAPITAL
	(dollars)	(dollars)	(dollars)
H1	1,620	697	228
H2	5,852	4,691	569
H3	12,894	11,498	1,139
H4	27,079	25,272	2,278
F1	1,710	745	235
F2	5,838	4,698	590
F3	12,772	11,376	1,177
F4	26,623	24,753	2,366

¹H = Handmove, F = Furrow, 1 = 1.0, 2 = 2.5,
3 = 5.0, 4 = 10.0, acre(s), respectively.

TABLE VII
INVESTMENT COST, SURFACE AREA, AND CAPACITY
FOR THE RESPECTIVE ACREAGES AND IRRIGATION
SYSTEMS FOR SCENARIO ONE

	INVESTMENT COST	SURFACE AREA	CAPACITY
	(dollars)	(acres)	(acre feet)
H1	9,108	12.25	16.89
H2	11,071	35.00	46.78
H3	11,117	57.40	79.11
H4	13,563	114.85	158.31
F1	6,940	12.56	17.31
F2	11,280	50.62	69.78
F3	13,816	101.24	139.55
F4	19,682	350.66	483.33

¹H = Handmove, F = Furrow, 1 = 1.0, 2 = 2.5,
3 = 5.0, 4 = 10.0, acre(s), respectively.

Individual producers would each provide only their respective share, (1/6), of the total cost of the irrigation project. The four acreages are again examined, consequently the total acreages being served by the irrigation district are 6, 15, 30, and 60 acres, respectively. Estimates are made for furrow and handmove technologies.

For the one acre, handmove system operation, net returns are estimated to be 2,014 dollars, ending cash flow is 1,481 dollars, and required operating capital is 228.00 dollars. The water collection structure required to support the enterprises would cover 12.25 acres of surface area, and have a capacity of approximately 16.89 acre feet of water. The individual producer's share of the investment cost of the complete irrigation system is 5,792 dollars. Results for scenario two are provided in Tables VIII and IX.

Scenario Three

Scenario three is designed to represent the potential economic benefits accruing to an individual member of an irrigation district from the available low interest state guaranteed loan funds. The same acreage assumptions and irrigation technologies assumed in scenarios one and two are used.

Net returns for the one acre, handmove system operation were estimated to be 2,014 dollars, ending cash flow was estimated at 2,279 dollars, and operating capital required was 228.00 dollars. To provide adequate water for irrigation, a surface water collection structure with a capacity of 16.89 acre feet and a surface area of 12.25 acres would be necessary. Results for scenario three are provided in Tables X and XI.

TABLE VIII
NET RETURNS, ENDING CASH FLOW, AND
OPERATING CAPITAL FOR
SCENARIO TWO

	NET RETURNS	CASH FLOW	OPERATING CAPITAL
	(dollars)	(dollars)	(dollars)
H1	2,014	1,481	228
H2	6,248	5,644	569
H3	13,517	12,874	1,139
H4	28,080	27,374	2,278
F1	2,194	1,773	235
F2	6,795	6,059	590
F3	13,667	13,202	1,177
F4	27,980	27,464	2,366

¹H = Handmove, F = Furrow, 1 = 1.0, 2 = 2.5,
3 = 5.0, 4 = 10.0, acre(s), respectively.

TABLE IX
INVESTMENT COST, SURFACE AREA, AND CAPACITY FOR
THE RESPECTIVE ACREAGES AND IRRIGATION
SYSTEMS FOR SCENARIO TWO

	INVESTMENT COST	SURFACE AREA	CAPACITY
	(dollars)	(acres)	(acre feet)
H1	5,792	12.25	16.89
H2	7,861	35.00	46.78
H3	8,258	57.40	79.11
H4	9,378	114.85	158.31
F1	4,715	12.56	17.31
F2	5,471	50.62	69.78
F3	5,930	101.24	139.55
F4	6,959	350.66	483.33

¹H = Handmove, F = Furrow, 1 = 1.0, 2 = 2.5,
3 = 5.0, 4 = 10.0, acre(s), respectively.

TABLE X
NET RETURNS, ENDING CASH FLOW, AND
OPERATING CAPITAL FOR
SCENARIO THREE

	NET RETURNS	CASH FLOW	OPERATING CAPITAL
	(dollars)	(dollars)	(dollars)
H1	2,014	2,279	228
H2	6,248	6,596	569
H3	13,517	13,925	1,139
H4	28,080	28,601	2,278
F1	2,194	2,387	235
F2	6,495	6,714	590
F3	13,667	13,916	1,177
F4	27,980	28,284	2,366

¹H = Handmove, F = Furrow, 1 = 1.0, 2 = 2.5,
3 = 5.0, 4 = 10.0, acre(s), respectively.

TABLE XI
INVESTMENT COST, SURFACE AREA, AND CAPACITY
FOR THE RESPECTIVE ACREAGES AND IRRIGATION
SYSTEMS FOR SCENARIO THREE

	INVESTMENT COST	SURFACE AREA	CAPACITY
	(dollars)	(acres)	(acre feet)
H1	5,792	12.25	16.89
H2	7,861	35.00	46.78
H3	8,258	57.40	79.11
H4	9,378	114.85	158.31
F1	4,715	12.56	17.31
F2	5,471	50.62	69.78
F3	5,930	101.24	139.55
F4	6,959	350.66	483.33

¹H = Handmove, F = Furrow, 1 = 1.0, 2 = 2.5,
3 = 5.0, 4 = 10.0, acre(s), respectively.

Comparison of Scenario One to Scenario Two

Scenario one addresses the individual specialty crop producer, faced with individual cost curves. Scenario two represents the impacts on an individual producer of joining a multi-member irrigation district.

The development of a multi-member irrigation district, would indeed substantially increase the net returns and cash flow of the producer. Also, irrigation districts can serve to substantially reduce individual farmer's investment costs.

For the one acre, handmove operation, the development of irrigation districts accounted for a 394.00 dollar increase in net returns, a 784.00 dollar increase in cash flow, and most importantly a 3,316 dollar decrease in the investment capital required by the producer as compared to the individual producer scenario.

Comparison of Scenario Two to Scenario Three

Comparison of results from scenario two and three facilitate the evaluation of the potential economic benefits to an individual member of an irrigation district from available low interest state guaranteed loan funds. There are minimal yet positive effects on the representative producers' ending cash flow. No change in the producers' net returns or operating capital needs are indicated between the two scenarios.

For the one acre, handmove operation, the availability of the low interest state guaranteed bond funds results in an increase of cash flow of 798.00 dollars above the cash flow for the irrigation district without the low interest loan.

Figure 4 and Figure 5 provide a graphical comparison of the per acre cash flow for the three scenarios. Figure 4 depicts per acre cash flow for the scenarios with furrow irrigation and Figure 5 the scenarios with handmove sprinkler irrigation. Two conclusions can be drawn from the figures. First, the increases in cash flow generated by the development of irrigation districts are substantial. Even greater increases are experienced when the low interest bond funds are used. Second, the increase in size has substantial effects on the per acre cash flow experienced by the producer. This result is due to the economies of size in the construction of the water structures.

Figure 6 allows for comparison of the per acre cash flow generated between the two irrigation technologies. The application efficiencies assumed for the irrigation technologies greatly effected the size of structure required to supply adequate water for specialty crop production and consequently the profit situation for the producer.

From Figure 6, the effects of the lower application efficiency for the furrow systems can be deduced. For scenario one, the cash flow for the handmove systems quickly over takes the cash flow for the furrow systems (at approximately two and one half acres), though the handmove systems do not greatly exceed the furrow within the range of the study sizes.

For scenario two the cash flow generated by the handmove systems doesn't exceed the cash flow of the furrow systems within the range of the acreage limitations, though it is conceivable that they do beyond the ten acre size. In this case however, the differences in per acre cash flow are more pronounced than the other two scenarios.

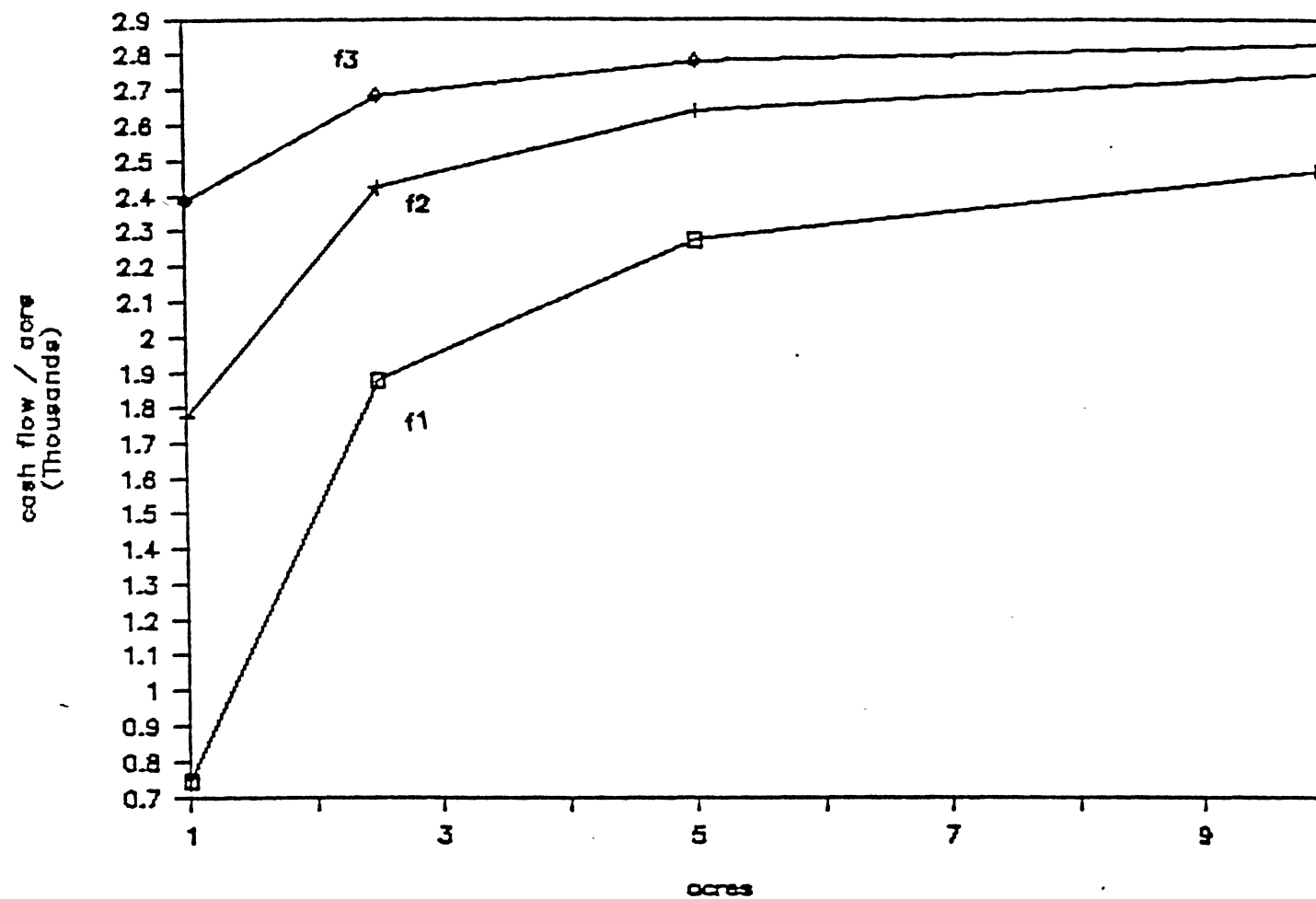


Figure 4. Per Acre Cash Flows for all Scenarios assuming Furrow Irrigation

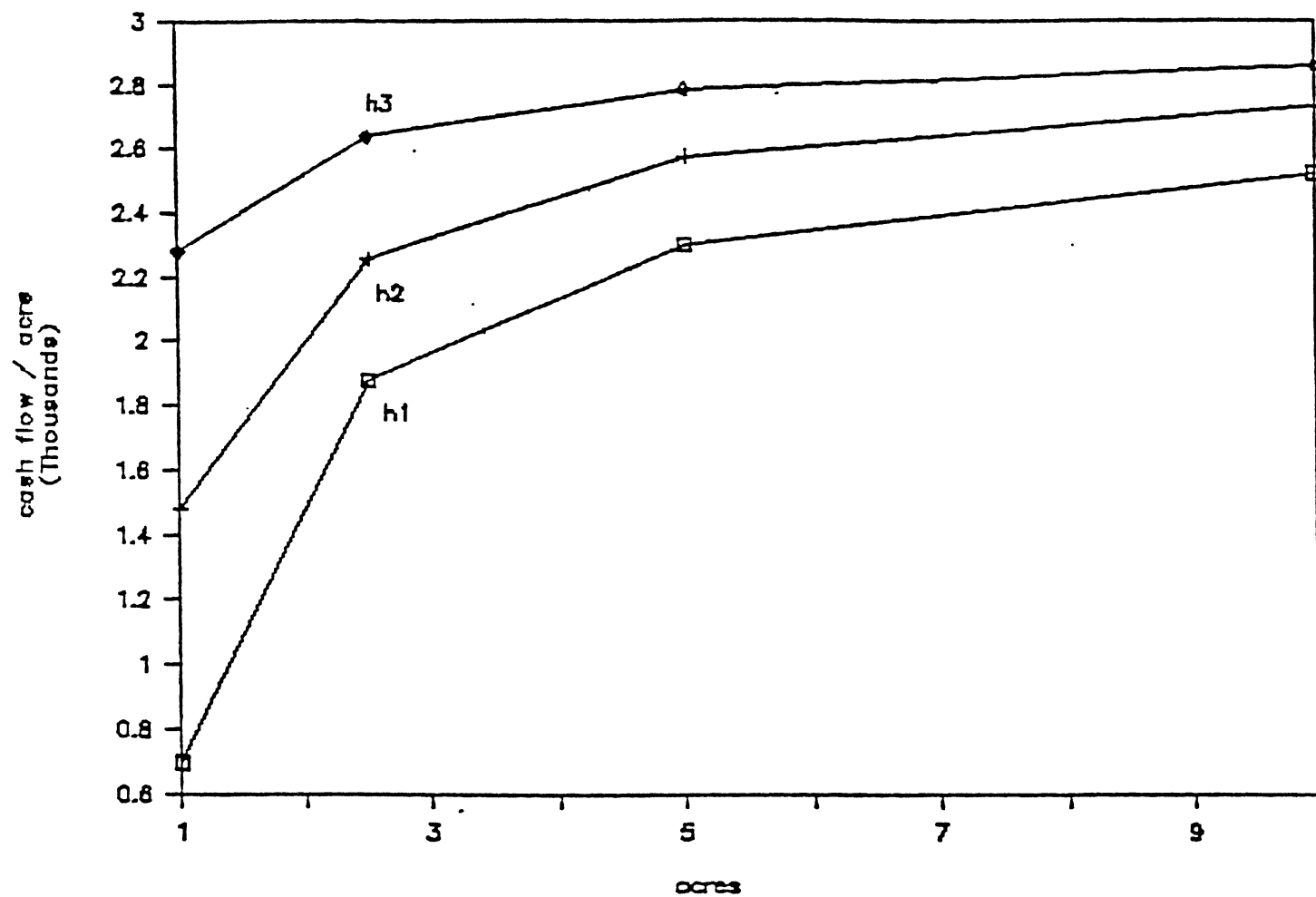


Figure 5. Per Acre Cash Flows for all Scenarios assuming Handmove. Irrigation

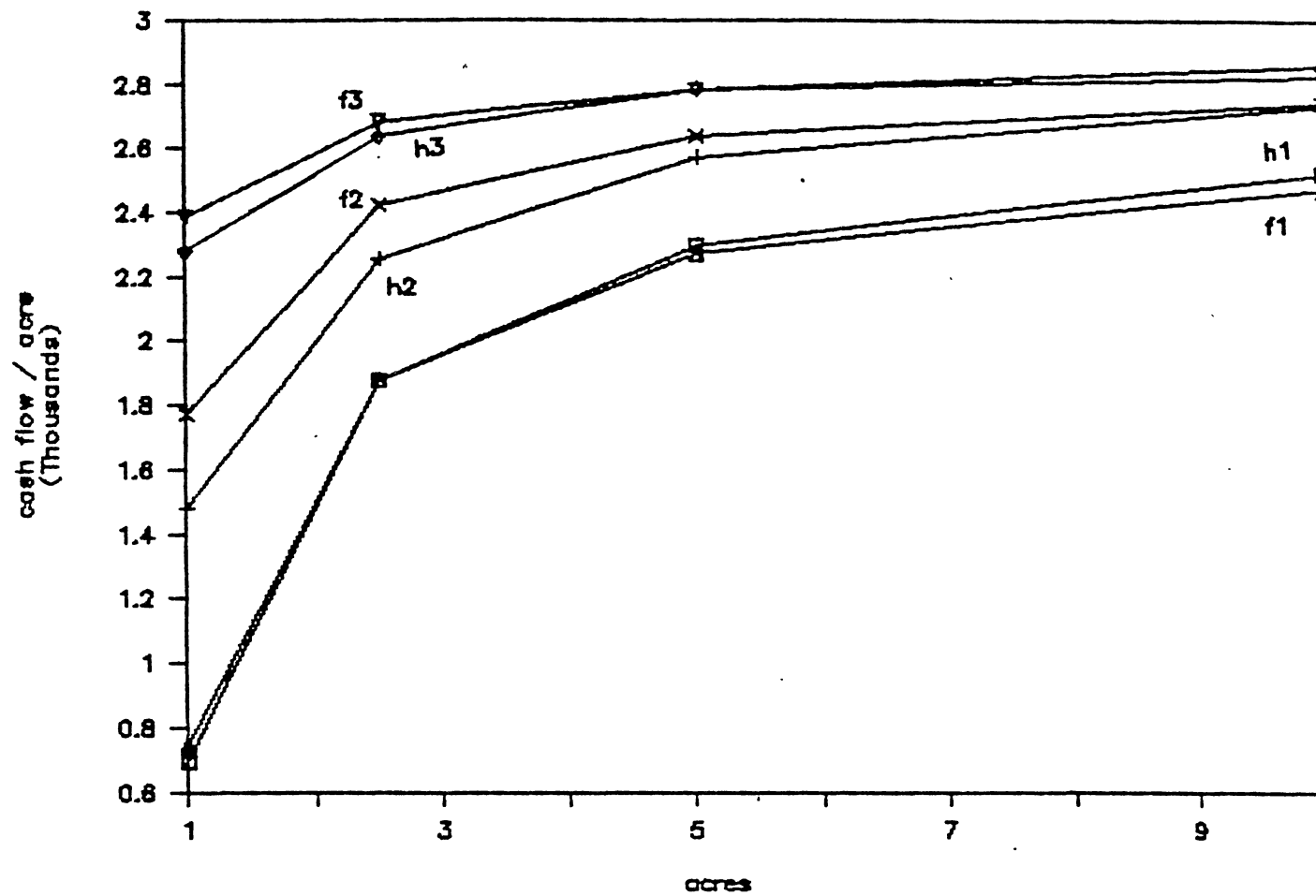


Figure 6. Comparison of Per Acre Cash Flows for Furrow and Handmove Irrigation for all Scenarios

The per acre cash flows generated by the furrow and handmove irrigation systems in scenario three follow closely the pattern of the scenario one results. Per acre cash flows for the handmove systems exceed the furrow systems at approximately the five acre size. As in scenario one, the difference is minimal yet positive within the study sizes.

Implications of Labor Demanded

The intensive use of labor in specialty crop production was discussed in Chapter I. Table XII provides the maximum weekly labor requirement for each scenario and the total labor requirement for the production period.

For the one acre scenarios, the maximum weekly labor requirement is approximately 5.00 units. The 2.5 acre scenarios have a maximum weekly labor requirement of approximately 12.5 units of labor while 5.0 and 10.0 acres have maximum weekly labor requirements of approximately 25.0 and 50.0 units, respectively. These results indicate that in the process of determining the size of the vegetable operation producers should evaluate their ability to secure adequate labor to effectively harvest a given acreage. Failure to secure such labor may require a reduction in the acres in specialty crop production.

The majority of the labor required for specialty crops is for harvest and due to the harsh conditions associated with this type of labor, may be considered undesirable by many of the study areas' unemployed. Therefore, an influx of seasonal and/or migrant workers could be the solution to the labor shortage and in turn a possible key

TABLE XII
TOTAL AND PEAK WEEKLY LABOR REQUIREMENTS
FOR ALL SCENARIOS IN
FORTY HOUR UNITS

SCENARIO	TOTAL REQUIREMENTS	PEAK REQUIREMENTS
H1	11.90	5.00
H2	29.74	12.51
H3	57.48	25.02
H4	118.96	50.04
F1	11.93	5.00
F2	29.84	12.51
F3	59.67	25.02
F4	119.35	50.04

¹H = Handmove, F = Furrow, 1 = 1.0, 2 = 2.5, 3 = 5.0,
4 = 10.0, acre(s), respectively.

to success for the specialty crop industry. It is possible to disburse the labor demand over a longer period of time to avoid the peak weekly demands. However, such action will result in non-optimal harvesting dates and in lower average product prices.

The above is especially true for the larger, commercialized operations. As indicated in Table VII, for the ten acre scenarios, 50.0 units of labor are required during the peak labor demand periods. The operation requires fifty laborers working eight hours per day for five days a week to be successful. What becomes even more challenging is providing sufficient labor when there are six, ten acre operations, as assumed in the irrigation district situations, which are all harvesting during the same time period. In this case, the importance of migrant and seasonal labor becomes even more pronounced as a key element in the success of a specialty crop industry.

Smaller, limited resource farms may perhaps be able to avoid the affects of labor shortages due to available unpaid family labor. Thus, small farms may be able to use irrigated vegetable enterprises to provide labor wages to otherwise unemployed or underemployed family members while generating economic returns to land resources and management skills.

CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH

Conclusions

Because of the reliance of southeastern Oklahoma on agriculture, it is conceivable that improvements in the agriculture sector could lead to substantial economic development for the area. For the specialty crop industry to be commercially successful, adequate marketing skills, labor, production information, and irrigation water must be present.

Using production economics and linear programming theory, this study deals with the task of providing sufficient water for irrigation application on specialty crops, and with the profitability of such specialty crop production. A separable programming model was used to determine the optimal specialty crop product mix, net returns, ending cash flow, operating capital and labor requirements for various situations. Estimates were made for three different specialty crop production scenarios: 1) individual producers; 2) irrigation districts; 3) irrigation districts with low interest bond funds. Each scenario implies a different irrigation cost curve each of which, realistically represents the cost of developing the respective irrigation systems.

A triple crop combination of spring spinach, summer cucumbers, and fall broccoli comprised the profit maximizing product mix. This crop

mix is easily adapted to southeastern Oklahoma and fits relatively well with the production capabilities of the areas' producers.

Scenario one addressed the economics of an individual producer faced with the costs of developing an individually owned surface water collection structure and the associated irrigation system. Scenario two was structured around the assumption that the representative producer in scenario one joined a six member irrigation district in an effort to reduce individual investment costs for the collection structure and associated irrigation system.

Over all sizes and both irrigation technologies, there are substantial increases in ending cash flows and net returns provided to a producer by joining a multi-member irrigation district. The cost curve for the structures is reduced for the irrigation districts due to the economies of size in the construction of the collection structure and the reduced share of the investment cost for the system.

Scenario three facilitated addressing the potential economic impacts to potential irrigation district members from the district receiving low interest state guaranteed funds for water development. The ending cash flow figures for this scenario are greater than comparable figures for scenario two by the amount of interest saved due to the lower interest rate used for the bond funds and the substantially longer payback period available in the state program.

It was determined from the results of this study, that though furrow irrigation systems' investment costs and labor requirements are lower than those of handmove sprinkler systems, producers benefit from using more efficient technology such as handmove sprinklers, which have a higher application efficiency than furrow irrigation systems. This

higher application efficiency explains why the furrow systems use more labor than the handmove sprinkler.

As expected, the per acre returns increased as acreage and the size of the water collection structures increased, for the vegetable production situations considered in this study. This result is largely due to the declining cost curve for all scenarios used to estimate structure costs.

Recommendations for Further Research

The success of a specialty crop industry in southeastern Oklahoma relies on many variables. It was the goal of this study to address one of these variables -- water. Variables exogenous to this study may need additional research.

The analysis neglects the organization and legal aspects of the formation of the irrigation districts. Numerous questions arise pertaining to the legal and organizational aspects of the district formation. Additional financial questions exist including management of districts' funds, insurance, and liabilities.

Other important questions this study does not address include the placement of water district structures, compensation to producers whose lands are used for structures, and rights and responsibilities of individual district members. Additional research is necessary to address these important aspects of irrigation district formation to aid potential district members in management decisions.

The importance of marketing to vegetable producers cannot be overemphasized. Research should continue to address marketing issues including potential markets, and desired crops. The role of an

established entity which could provide marketing assistance to local producers until marketing channels are secured should be evaluated. The REDARK Development Association, in conjunction with Oklahoma State University, the Tennessee Valley Authority, and other State and Federal entities is a multi-purpose public trust which has provided invaluable marketing assistance to growers in Atoka county.

In many instances, an organized group representing participating growers such as a cooperative can be beneficial to a local industry. The Three Rivers Produce Association in Atoka county provides producers an effective means of processing and marketing local products. The organization provides an effective means of disseminating information as well as an organization for production planning purposes. Work should continue to identify the best method of organizing such a group, its role and responsibilities.

Available labor in southeastern Oklahoma, especially for harvesting, looms as a possible impediment to the success of a specialty crop industry. Insufficient labor for harvesting will result in crops being planted, maintained, and/or harvested at non-optimal times which can lead to reduced yields, quality or prices. These problems can lead directly to reduced profits and perhaps, if the problems persist, growers could lose buyers. Research should be conducted to address labor issues such as hiring schemes, length of labor procurement, and the effects on profits of insufficient labor. This concern is especially true for crops with a short, labor intensive, harvest period, where large numbers of laborers are required to effectively harvest crops to prevent a drop in product quality or price. Though low-income, small scale producers with adequate family labor can perhaps

escape this labor shortage on a small acreage, larger commercial operations will become increasingly dependent on migrant labor as the sizes of their operations increase.

An important aspect of the production of any good is risk. Research needs to be conducted which addresses such topics as Oklahoma price risk and yield risk. Information about drops in yields, prices, and/or quality because of planting date delays would be beneficial to producers.

As interest in specialty crop production increases in southeastern Oklahoma, potential producers will need information on the latest production and management practices. Therefore, efforts in disseminating information regarding commercial production to local producers may need to be increased. A major step towards this goal has already been taken with the placement in Atoka county of an Oklahoma agricultural experiment station devoted to fruit and vegetable research.

The high returns estimated for handmove sprinkler alternatives considered in this study indicate that though technology is initially more expensive, long run benefits may make more efficient technology desirable. Therefore, other advanced irrigation systems should be investigated.

Finally, a regional impact study of the effects of the developing specialty crop industry would be useful. The economic activity and opportunity generated by the industry, would alter the sufficiency of public services, the level of local revenues from taxes and fees, and other important elements of the area's economy. The ability of local officials to estimate these impacts would improve the effectiveness of planning and decision-making of local officials.

Although southeastern Oklahoma may never be the nation's leader in specialty crop production, there exists a significant opportunity to develop markets in which southeastern Oklahoma has a definite advantage in transportation over the established specialty crop states such as California and Florida. Climatic and agronomic factors clearly indicate that production possibilities are excellent, and current marketing arrangements are proving productive and profitable. If adequate irrigation and adequate labor can be made available, southeastern Oklahoma could certainly be a source of high quality, fresh produce for many major cities in the Midwest. Such development would provide a generous economic boost to the area's poor and unemployed.

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APPENDIX
ENTERPRISE BUDGETS

TABLE XIII

SPRING BROCCOLI TRANSPLANTED BUDGET

SPRING BROCCOLI, TRANSPLANT, OKLAHOMA SANDY LOAM SOILS, IRRIGATED, OWNED EQUIPMENT WITH HAND HARVEST 22 LB. CARTONS, ADJ. DALLAS WHOLESALE PRICE.					
OPERATING INRUTS:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
HERB TREFLAN 4E	ACRE	4.450	1.000	4.45	
15-15-15 FERT.	CWT.	9.750	3.000	29.25	
RNTFERTSPRD/ACRE	ACRE	1.250	3.000	3.75	
TRANSPLANTS	THPL	30.000	14.500	435.00	
TRANSPLANT LABOR	HR.	4.650	18.000	83.70	
NITROGEN (N)	LBS.	0.220	80.000	17.60	
PEST LANNATE 1.8	ACRE	12.150	6.000	72.90	
CARTONS	CART	1.020	350.000	357.00	
HAND HARVESTING	HR.	4.650	105.000	488.25	
GRADING & MKTG	CART	1.330	350.000	465.50	
ANNUAL OPERATING CAPITAL	DOL.	0.130	96.018	12.48	
LABOR CHARGES	HR.	4.877	12.792	62.39	
MACHINERY FUEL,LUBE,REPAIRS	ACRE			36.53	
IRRIGATION FUEL,LUBE,REPAIRS	ACRE			9.08	
TOTAL OPERATING COST				2077.88	
FIXED COSTS				VALUE	YOUR VALUE
MACHINERY					
INTEREST AT 13.0%	DOL.	102.317			
DEPR. TAXES,INSUR.	DOL.	135.305			
IRRIGATION					
INTEREST AT 13.0%	DOL.	41.800			
DEPR.: TAXES,INSUR.	DOL.	34.100			
LAND					
INTEREST AT 0.0%	DOL.	0.000			
TAXES	DOL.	0.000			
TOTAL FIXED COSTS		313.52			
PRODUCTION:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
BROCCOLI	CART	7.290	350.000	2551.50	
RETURNS ABOVE TOTAL OPERATING COSTS				473.62	
RETURNS ABOVE ALL COSTS EXCEPT OVERHEAD,RISK AND MANAGEMENT				160.10	
TREFLAN .5 LB. AI:					
LANNATE 10 OZ. AI:					
SIDEDRESS 120 LBS. 34-0-0 FERT. TWICE.					
					WICKWIRE,SCHATZER NOTES
PROCESSED BY DEPT. OF AGRI. ECON. - OKLAHOMA STATE UNIVERSITY PROGRAM DEVELOPED BY DEPT. OF AGRI. ECON. OKLAHOMA STATE UNIVERSITY.					

TABLE XIV
CANTALOUPE BUDGET

SUMMER CANTALOUPE, OKLAHOMA SANDY LOAM SOILS, IRRIGATED, OWNED EQUIPMENT WITH HAND HARVEST 38 LB. CRATES, ADJ. DALLAS WHOLESALE PRICE.					
OPERATING INPUTS:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
HERB PREFAR 4E	ACRE	24.750	1.000	24.75	
15-15-15 FERT.	CWT.	9.750	3.000	29.25	
RNTFERTSPRD/ACRE	ACRE	1.250	2.000	2.50	
SEED	LBS.	6.000	2.000	12.00	
PEST LANNATE 1.8	ACRE	12.150	4.000	48.60	
HERB TREFLAN 4E	ACRE	4.450	1.000	4.45	
NITROGEN (N)	LBS.	0.220	60.000	13.20	
HAND HOEING	HR.	4.650	8.000	37.20	
CRATES	CRAT	1.020	250.000	255.00	
HAND HARVESTING	HR.	4.650	100.000	465.00	
GRADING & MKTG	CRAT	0.940	250.000	235.00	
ANNUAL OPERATING CAPITAL	DOL.	0.130	46.740	6.08	
LABOR CHARGES	HR.	4.860	11.293	54.89	
MACHINERY FUEL, LUBE, REPAIRS	ACRE			29.62	
IRRIGATION FUEL, LUBE, REPAIRS	ACRE			14.02	
TOTAL OPERATING COST				1231.55	
FIXED COSTS			VALUE	YOUR VALUE	
MACHINERY					
INTEREST AT 13.0%	DOL.	87.977			
DEPR., TAXES, INSUR.	DOL.	116.720			
IRRIGATION					
INTEREST AT 13.0%	DOL.	64.600			
DEPR., TAXES, INSUR.	DOL.	52.700			
LAND					
INTEREST AT 0.0%	DOL.	0.000			
TAXES	DOL.	0.000			
TOTAL FIXED COSTS		322.00			
PRODUCTION:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
CANTALOUPE	CRAT	6.560	250.000	1640.00	
RETURNS ABOVE TOTAL OPERATING COSTS				408.45	
RETURNS ABOVE ALL COSTS EXCEPT OVERHEAD, RISK AND MANAGEMENT				86.45	
PREPLANT PREFAR 1 LB. AT 3 FOOT BAND ; WICKWIRE, SCHATZER LANNATE 10 OZ. AI; POST-MERG TREFLAN 4E .5 LB. AI; MOTES SIDEDRESS 180 LBS. 34-0-0 AT VINE RUNNING.					
PROCESSED BY DEPT. OF AGRI. ECON. - OKLAHOMA STATE UNIVERSITY PROGRAM DEVELOPED BY DEPT. OF AGRI. ECON. OKLAHOMA STATE UNIVERSITY					

TABLE XV
CUCUMBER BUDGET

CUCUMBER, OKLAHOMA SANDY LOAM SOILS, IRRIGATED, OWNED EQUIPMENT WITH HAND HARVEST 10/9 BUSHEL CARTONS, ADJ. DALLAS WHOLESALE PRICE.					
OPERATING INPUTS:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
HERB PREFAR 4E	ACRE	24.750	1.000	24.75	
SEED	LBS.	14.000	1.500	21.00	
15-15-15 FERT.	CWT.	9.750	3.500	34.13	
RNT FERTS PRO/ACRE	ACRE	1.250	2.000	2.50	
PEST PYDRIN 2.4E	ACRE	8.200	4.000	32.80	
HAND HOEING	HR.	4.650	12.000	55.80	
HERB TREFLAN 4E	ACRE	4.450	1.000	4.45	
NITROGEN (N)	LBS.	0.220	50.000	11.00	
CARTONS	CART	1.020	300.000	306.00	
HAND HARVESTING	HR.	4.650	90.000	418.50	
GRADING & MKTG	CART	1.000	300.000	300.00	
ANNUAL OPERATING CAPITAL	DOL.	0.130	35.731	4.65	
LABOR CHARGES	HR.	4.859	10.191	49.51	
MACHINERY FUEL, LUBE, REPAIRS	ACRE			26.55	
IRRIGATION FUEL, LUBE, REPAIRS	ACRE			13.20	
TOTAL OPERATING COST				1304.83	
FIXED COSTS				VALUE	YOUR VALUE
MACHINERY					
INTEREST AT 13.0%	DOL.	77.023			
DEPR., TAXES, INSUR.	DOL.	102.331			
IRRIGATION					
INTEREST AT 13.0%	DOL.	60.800			
DEPR., TAXES, INSUR.	DOL.	49.600			
LAND					
INTEREST AT 0.0%	DOL.	0.000			
TAXES	DOL.	0.000			
TOTAL FIXED COSTS		289.75			
PRODUCTION:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
CUCUMBERS	CART	9.350	300.000	2805.00	
RETURNS ABOVE TOTAL OPERATING COSTS				1500.17	
RETURNS ABOVE ALL COSTS EXCEPT OVERHEAD, RISK AND MANAGEMENT				1210.42	
PREPLANT PREFAR 3 LB. AI 3 FT BAND; WICKWIRE, SCHATZER PYDRIN .15 LB. AI; POST-MERG TREFLAN 4E 3LB. AI; MOTES 150 LBS. 34-0-0 FERT.					
PROCESSED BY DEPT. OF AGRI. ECON. - OKLAHOMA STATE UNIVERSITY PROGRAM DEVELOPED BY DEPT. OF AGRI. ECON. OKLAHOMA STATE UNIVERSITY					

TABLE XVI

OKRA BUDGET

OKRA, OKLAHOMA SANDY LOAM SOILS, IRRIGATED, OWNED EQUIPMENT WITH HAND HARVEST 18 LB. CARTONS; ADJ. DALLAS WHOLESALE PRICE.					
OPERATING INPUTS:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
HERB TREFLAN 4E	ACRE	4.450	1.000	4.45	
15-15-15 FERT	CWT.	9.750	2.000	19.50	
RNT FERTSPRD/ACRE	ACRE	1.250	2.000	2.50	
SEED	LBS.	1.000	10.000	10.00	
HAND HOEING	HR.	4.650	6.000	27.90	
NITROGEN (N)	LBS.	0.220	20.000	4.40	
PEST SEVIN XLR	ACRE	5.770	3.000	17.31	
CARTONS	CART	1.020	500.000	510.00	
HAND HARVESTING	HR.	4.650	290.500	1350.82	
HAND HARVESTING	HR.	4.650	9.500	44.17	
GRADING & MKTG	CART	0.580	485.000	281.30	
GRADING & MKTG	CART	0.580	15.000	8.70	
ANNUAL OPERATING CAPITAL	DOL.	0.130	65.853	9.08	
LABOR CHARGES	HR.	4.864	12.630	61.44	
MACHINERY FUEL, LUBE, REPAIRS	ACRE			33.57	
IRRIGATION FUEL, LUBE, REPAIRS	ACRE			14.03	
TOTAL OPERATING COST				2399.17	
FIXED COSTS			VALUE	YOUR VALUE	
MACHINERY					
INTEREST AT 13.0%	DOL.	93.496			
DEPR., TAXES, INSUR.	DOL.	123.892			
IRRIGATION					
INTEREST AT 13.0%	DOL.	64.600			
DEPR., TAXES, INSUR.	DOL.	52.700			
LAND					
INTEREST AT 0.0%	DOL.	0.000			
TAXES	DOL.	0.000			
TOTAL FIXED COSTS		334.69			
PRODUCTION:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
OKRA	CART	5.240	485.000	2541.40	
OKRA	CART	5.240	15.000	78.60	
TOTAL RECEIPTS				2620.00	
RETURNS ABOVE TOTAL OPERATING COSTS				220.83	
RETURNS ABOVE ALL COSTS EXCEPT OVERHEAD, RISK AND MANAGEMENT				-113.86	
TREFLAN .5 LB. AI; SEVIN 1 LB. AI; SIDEDRESS 60 LB. 34-0-0 FERT.					
				WICKWIRE, SCHATZER	
				NOTES	
PROCESSED BY DEPT. OF AGRI. ECON. - OKLAHOMA STATE UNIVERSITY PROGRAM DEVELOPED BY DEPT. OF AGRI. ECON. OKLAHOMA STATE UNIVERSITY					

TABLE XVII
SNAP BEAN BUDGET

SNAP BEANS, OKLAHOMA SANDY LOAM SOILS, IRRIGATED, OWNED EQUIPMENT WITH HAND HARVEST 30 LB. BASKETS, ADJ. DALLAS WHOLESALE PRICE.					
OPERATING INPUTS:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
HERB TREFLAN 4E	ACRE	4.450	1.000	4.45	
15-15-15 FERT.	CWT.	9.750	2.500	24.38	
RNTFERTSPRD/ACRE	ACRE	1.250	2.000	2.50	
SEED	LBS.	1.400	80.000	112.00	
PEST LANNATE 1.8	ACRE	12.150	3.000	36.45	
NITROGEN (N)	LBS.	0.220	25.000	5.50	
HAND HOEING	HR.	4.650	4.000	18.60	
BASKETS	BU.	1.020	120.000	122.40	
HAND HARVESTING	HR.	4.650	60.000	279.00	
GRADING & MKTG	BU.	0.830	120.000	99.60	
ANNUAL OPERATING CAPITAL	DOL.	0.130	34.491	4.48	
LABOR CHARGES	HR.	4.878	9.706	47.35	
MACHINERY FUEL,LUBE,REPAIRS	ACRE			27.72	
IRRIGATION FUEL,LUBE,REPAIRS	ACRE			6.60	
TOTAL OPERATING COST				791.03	
FIXED COSTS				VALUE	YOUR VALUE
MACHINERY					
INTEREST AT 13.0%	DOL.	80.538			
DEPR., TAXES, INSUR.	DOL.	107.039			
IRRIGATION					
INTEREST AT 13.0%	DOL.	30.400			
DEPR., TAXES, INSUR.	DOL.	24.800			
LAND					
INTEREST AT 0.0%	DOL.	0.000			
TAXES	DOL.	0.000			
TOTAL FIXED COSTS		242.78			
PRODUCTION:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
GREEN BEANS	BU.	10.000	120.000	1200.00	
RETURNS ABOVE TOTAL OPERATING COSTS				408.97	
RETURNS ABOVE ALL COSTS EXCEPT OVERHEAD, RISK AND MANAGEMENT				166.19	
TREFLAN .5 LB. AI; LANNATE 10 OZ. AI; SIDEDRESS 75 LBS. 34-0-0 FERT.					
				WICKWIRE, SCHATZER MOTES	

PROCESSED BY DEPT. OF AGRI. ECON. - OKLAHOMA STATE UNIVERSITY
PROGRAM DEVELOPED BY DEPT. OF AGRI. ECON. OKLAHOMA STATE UNIVERSITY

TABLE XVIII
SWEET CORN BUDGET

SUMMER SWEET CORN, OKLAHOMA SANDY LOAM SOIL, IRRIGATED, OWNED EQUIPMENT WITH HAND HARVEST 45 LB. CRATES, ADJ. DALLAS WHOLESALE PRICE.					
OPERATING INPUTS:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
SEED	LBS.	3.000	10.000	30.00	
HERB LASSO4E	ACRE	17.330	1.000	17.33	
15-15-15 FERT.	CWT	9.750	3.500	34.13	
RNT FERTSPRD/ACRE	ACRE	1.250	2.000	2.50	
NITROGEN (N)	LBS.	0.220	70.000	15.40	
HAND HOEING	HR.	4.650	4.000	18.60	
PEST PYDRIN 2.4E	ACRE	8.200	9.000	73.80	
CRATES	CRAT	1.020	180.000	183.60	
HAND HARVESTING	HR.	4.650	30.000	139.50	
GRADING & MKTG	CRAT	0.510	180.000	91.80	
ANNUAL OPERATING CAPITAL	DOL.	0.130	35.694	4.64	
LABOR CHARGES	HR.	4.865	10.509	51.13	
MACHINERY FUEL, LUBE, REPAIRS	ACRE			28.19	
IRRIGATION FUEL, LUBE, REPAIRS	ACRE			11.55	
TOTAL OPERATING COST				702.17	
FIXED COSTS				VALUE	YOUR VALUE
MACHINERY					
INTEREST AT 13.0%	DOL.	83.780			
DEPR., TAXES, INSUR.	DOL.	110.994			
IRRIGATION					
INTEREST AT 13.0%	DOL.	53.200			
DEPR., TAXES, INSUR.	DOL.	43.400			
LAND					
INTEREST AT 0.0%	DOL.	0.000			
TAXES	DOL.	0.000			
TOTAL FIXED COSTS		291.37			
PRODUCTION:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
SWEET CORN	CRAT	7.620	180.000	1371.60	
RETURNS ABOVE TOTAL OPERATING COSTS				669.43	
RETURNS ABOVE ALL COSTS EXCEPT OVERHEAD, RISK AND MANAGEMENT				378.06	
PYDRIN .15 LB. AI; LASSO 3 LBS. AI; SIDEDRESS 205 LBS. 34-0-0 FERT.					
					WICKWIRE, SCHATZER NOTES
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TABLE XIX

SWEET POTATO BUDGET

SWEET POTATOES, OKLAHOMA SANDY LOAM SOILS, IRRIGATED, OWNED EQUIPMENT WITH HAND HARVEST BUSHEL BASKETS; ADJ. DALLAS WHOLESALE PRICE					
OPERATING INPUTS:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
FUNG MOCAP 10G	ACRE	4.560	80.000	364.80	
HERB ENIDE 90W	ACRE	49.170	1.000	49.17	
15-15-15 FERT.	CWT.	9.750	2.000	19.50	
RNTFERTSPRD/ACRE	ACRE	1.250	1.000	1.25	
TRANSPLANTS	THPL	20.000	13.000	260.00	
TRANSPLANT LABOR	HR.	4.650	17.000	79.05	
PEST PARATHION 8	ACRE	1.400	2.000	2.80	
HAND HOEING	HR.	4.650	24.000	111.60	
HAND HARVESTING	HR.	4.650	90.000	418.50	
BASKETS	BU.	1.020	300.000	306.00	
GRADING & MKTG	BU.	0.680	300.000	198.00	
ANNUAL OPERATING CAPITAL	DOL.	0.130	347.308	45.15	
LABOR CHARGES	HR.	4.861	16.165	78.58	
MACHINERY FUEL LUBE, REPAIRS	ACRE			43.67	
IRRIGATION FUEL LUBE, REPAIRS	ACRE			19.80	
TOTAL OPERATING COST				1997.87	
FIXED COSTS				VALUE	YOUR VALUE
MACHINERY					
INTEREST AT 13.0%	DOL.	126.284			
DEPR. TAXES, INSUR.	DOL.	168.371			
IRRIGATION					
INTEREST AT 13.0%	DOL.	91.200			
DEPR. TAXES, INSUR.	DOL.	74.400			
LAND					
INTEREST AT 0.0%	DOL.	0.000			
TAXES	DOL.	0.000			
TOTAL FIXED COSTS		460.25			
PRODUCTION:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
SWEET POTATOES	BU.	8.110	300.000	2433.00	
RETURNS ABOVE TOTAL OPERATING COSTS				435.13	
RETURNS ABOVE ALL COSTS EXCEPT OVERHEAD, RISK AND MANAGEMENT				-25.12	
MOCAP 10E 4 LBS. AI; ENIDE 5 LBS. AI; PARATHION .5 LB. AI; DIG WITH 2 X 14 PLOW.				WICKWIRE, SCHATZER NOTES	

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TABLE XX

STAKED TOMATOES BUDGET

STAKED TOMATOES, OKLAHOMA SANDY LOAM SOILS, IRRIGATED, OWNED EQUIPMENT WITH HAND HARVEST 30 LB. LUGS, ADJ. DALLAS WHOLESALE PRICE.					
OPERATING INPUTS:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
HERB TREFLAN 4E	ACRE	4.450	1.000	4.45	
15-15-15 FERT.	CWT.	9.7500	3.350	32.66	
POTASH (K2O)	LBS.	0.0800	100.000	8.00	
RNTFERTSPRD/ACRE	ACRE	1.2500	2.000	2.50	
TRANSPLANTS	THPL	50.0000	5.000	250.00	
TRANSPLANT LABOR	HR.	4.6500	8.000	37.20	
STAKES	EACH	0.2500	834.000	208.50	
STRING	LBS.	1.2500	30.000	37.50	
STAKING LABOR	HR.	4.6500	50.000	232.50	
PRUNING & TIEING	HR.	4.6500	180.000	837.00	
HAND HOEING	HR.	4.6500	9.000	41.85	
PEST LANNATE 1.8	ACRE	12.1500	10.000	121.50	
BACT KOCIDE 101	ACRE	11.3500	10.000	113.50	
FUNG MANZATE 200.	ACRE	4.2200	4.000	16.88	
NITROGEN (N)	LBS.	0.2200	50.000	11.00	
FUNG BRAVO 6F	ACRE	10.5600	6.000	63.36	
LUGS	LUGS	0.610	700.000	427.00	
HAND HARVESTING	HR.	4.6500	200.000	930.00	
GRADING & MKTG	LUGS	0.7500	700.000	525.00	
ANNUAL OPERATING CAPITAL	DOL.	0.130	381.807	49.63	
LABOR CHARGES	HR.	4.878	21.130	103.06	
MACHINERY FUEL,LUBE,REPAIRS	ACRE			43.95	
IRRIGATION FUEL,LUBE,REPAIRS	ACRE			14.85	
TOTAL OPERATING COST				4112.00	
FIXED COSTS			VALUE	YOUR VALUE	
MACHINERY					
INTEREST AT 13.0%	DOL.	104.617			
DEPR., TAXES, INSUR.	DOL.	138.251			
IRRIGATION					
INTEREST AT 13.0%	DOL.	68.400			
DEPR., TAXES, INSUR.	DOL.	55.800			
LAND					
INTEREST AT 0.0%	DOL.	0.000			
TAXES	DOL.	0.000			
TOTAL FIXED COSTS		367.07			
PRODUCTION:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
TOMATOES	LUGS	7.500	700.000	5250.00	
RETURNS ABOVE TOTAL OPERATING COSTS				1138.00	
RETURNS ABOVE ALL COSTS EXCEPT OVERHEAD, RISK AND MANAGEMENT				770.94	
REPLACE 1/3 OF STAKES PER YR.; BRAVO 1.5 LB. AI; WICKWIRE, SCHATZER KOCIDE 3 LB. AI; MANZATE 1.5 LB AI; TREFLAN .5 LB. AI; MOTES LANNATE 10 OZ. AI; 150 LBS. 34-0-0 FERT.					
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TABLE XXI
WATERMELON BUDGET

SUMMER WATERMELON, OKLAHOMA SANDY LOAM SOILS, IRRIGATED, OWNED EQUIPMENT WITH HAND HARVEST CWT. BULK, ADJ. DALLAS WHOLESALE PRICE.					
OPERATING INPUTS:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
HERB PREFAR 4E	ACRE	8.250	1.000	8.25	
SEED	LBS.	6.000	1.500	9.00	
15-15-15 FERT.	CWT.	9.750	2.500	24.38	
POTASH (K2O)	LBS.	0.080	50.000	4.00	
RNTFERTSPRD/ACRE	ACRE	1.250	1.000	1.25	
HERB TREFLAN 4E	ACRE	4.450	1.000	4.45	
PEST PYDRIN 2.4E	ACRE	8.200	3.000	24.60	
HAND MOEING	HR.	4.650	9.000	41.85	
FRUIT PRUNING	HR.	4.650	4.000	18.60	
HAND HARVESTING	HR.	4.650	28.000	130.20	
GRADING & MKTG	CWT.	0.890	140.000	124.60	
ANNUAL OPERATING CAPITAL	DOL.	0.130	39.769	5.17	
LABOR CHARGES	HR.	4.858	10.795	52.45	
MACHINERY FUEL,LUBE,REPAIRS	ACRE			28.24	
IRRIGATION FUEL,LUBE,REPAIRS	ACRE			14.03	
TOTAL OPERATING COST				491.06	
FIXED COSTS				VALUE	YOUR VALUE
MACHINERY					
INTEREST AT 13.0%	DOL.	81.786			
DEPR., TAXES, INSUR.	DOL.	108.652			
IRRIGATION					
INTEREST AT 13.0%	DOL.	64.600			
DEPR., TAXES, INSUR.	DOL.	52.700			
LAND					
INTEREST AT 0.0%	DOL.	0.000			
TAXES	DOL.	0.000			
TOTAL FIXED COSTS		307.74			
PRODUCTION:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
WATERMELONS	CWT.	4.880	140.000	683.20	
RETURNS ABOVE TOTAL OPERATING COSTS				192.14	
RETURNS ABOVE ALL COSTS EXCEPT OVERHEAD, RISK AND MANAGEMENT				-115.59	
PYDRIN .15 LB. AI; PREPLANT PREFAR 4E 1 LB. AI 3 FOOT BAND; POST-MERGTREFLAN 4E .5 LB. AI;					
					WICKWIRE, SCHATZER NOTES
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TABLE XXII

SUMMER SQUASH BUDGET

SUMMER SQUASH, OKLAHOMA SANDY LOAM SOILS, IRRIGATED, OWNED EQUIPMENT WITH HAND HARVEST 20 LB. CARTONS, ADJ. DALLAS WHOLESALE PRICE.					
OPERATING INPUTS:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
HERB AMIBEN 2E	ACRE	30.720	1.000	30.72	
SEED	LBS.	22.000	4.000	88.00	
15-15-15 FERT.	CWT.	9.750	3.000	29.25	
RNT FERTSPRD/ACRE	ACRE	1.250	2.000	2.50	
PEST PYDRIN 2.4E	ACRE	8.200	6.000	49.20	
HAND HOEING	HR.	4.650	24.000	111.60	
NITROGEN (N)	LBS.	0.220	30.000	6.60	
CARTONS	CART	1.020	500.000	510.00	
HAND HARVESTING	HR.	4.650	200.000	930.00	
GRADING & MKTG	CART	1.030	500.000	515.00	
ANNUAL OPERATING CAPITAL	DOL.	0.130	66.761	8.68	
LABOR CHARGES	HR.	4.864	10.159	49.41	
MACHINERY FUEL, LUBE, REPAIRS	ACRE			27.05	
IRRIGATION FUEL, LUBE, REPAIRS	ACRE			11.55	
TOTAL OPERATING COST				2369.55	
FIXED COSTS				VALUE	YOUR VALUE
MACHINERY					
INTEREST AT 13.0%	DOL.	79.314			
DEPR., TAXES, INSUR.	DOL.	105.266			
IRRIGATION					
INTEREST AT 13.0%	DOL.	53.200			
DEPR., TAXES, INSUR.	DOL.	43.400			
LAND					
INTEREST AT 0.0%	DOL.	0.000			
TAXES	DOL.	0.000			
TOTAL FIXED COSTS		281.18			
PRODUCTION:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
SUMMER SQUASH	CART	4.710	500.000	2355.00	
RETURNS ABOVE TOTAL OPERATING COSTS				-14.55	
RETURNS ABOVE ALL COSTS EXCEPT OVERHEAD, RISK AND MANAGEMENT				-295.73	
PYDRIN .15 LB. AI; AMIBEN 3 LB. AI; SIDEDRESS 90 LBS. 34-0-0 FERT.					WICKWIRE, SCHATZER NOTES
PROCESSED BY DEPT. OF AGRI. ECON. - OKLAHOMA STATE UNIVERSITY PROGRAM DEVELOPED BY DEPT. OF AGRI. ECON. OKLAHOMA STATE UNIVERSITY					

TABLE XXIII
SOUTHERN PEAS BUDGET

SOUTHERN PEAS, OKLAHOMA SANDY LOAM SOILS, IRRIGATED, OWNED EQUIPMENT WITH HAND HARVEST 24 LB. BASKETS, ADJ. DALLAS WHOLESALE PRICE.					
OPERATING INPUTS:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
HERB TREFLAN 4E	ACRE	4.450	1.000	4.45	
SEED	LBS.	1.200	20.000	24.00	
15-15-15 FERT.	CWT.	9.750	1.500	14.63	
RNTFERTSPRD/ACRE	ACRE	1.250	2.000	2.50	
PEST SEVIN XLR	ACRE	5.770	2.000	11.54	
HAND HOEING	HR.	4.650	8.000	37.20	
NITROGEN (N)	LBS.	0.220	25.000	5.50	
BASKETS	BU.	1.020	125.000	127.50	
HAND HARVESTING	HR.	4.650	63.000	292.95	
GRADING & MKTG	BU.	0.500	125.000	62.50	
ANNUAL OPERATING CAPITAL	DOL.	0.130	23.041	3.00	
LABOR CHARGES	HR.	4.868	11.587	56.41	
MACHINERY FUEL, LUBE, REPAIRS	ACRE			31.50	
IRRIGATION FUEL, LUBE, REPAIRS	ACRE			11.55	
TOTAL OPERATING COST				685.21	
FIXED COSTS				VALUE	YOUR VALUE
MACHINERY					
INTEREST AT 13.0%	DOL.	92.416			
DEPR., TAXES, INSUR.	DOL.	122.655			
IRRIGATION					
INTEREST AT 13.0%	DOL.	53.200			
DEPR., TAXES, INSUR.	DOL.	43.400			
LAND					
INTEREST AT 0.0%	DOL.	0.000			
TAXES	DOL.	0.000			
TOTAL FIXED COSTS		311.67			
PRODUCTION:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
SOUTHERN PEAS	BU.	8.000	125.000	1000.00	
RETURNS ABOVE TOTAL OPERATING COSTS				314.79	
RETURNS ABOVE ALL COSTS EXCEPT OVERHEAD, RISK AND MANAGEMENT				3.12	
SEVIN .5 LB. AI;					
TREFLAN .5 LB. AI;					
SIDEDRESS 75 LBS. 34-0-0 FERT.					

WICKWIRE, SCHATZER
NOTES

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TABLE XXIV
SPRING BROCCOLI SEEDED BUDGET

SPRING BROCCOLI, SEEDED, OKLAHOMA SANDY LOAM SOILS, IRRIGATED, OWNED EQUIPMENT WITH HARVEST 22 LB. CARTON, ADJ. DALLAS WHOLESALE PRICE.					
OPERATING INPUTS:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
SEED	LBS.	200.000	1.000	200.00	
HERB TREFLAN 4E	ACRE	4.450	1.000	4.45	
15-15-15 FERT.	CWT.	9.750	3.000	29.25	
RNTFERTSPRD/ACRE	ACRE	1.250	3.000	3.75	
NITROGEN (N)	LBS.	0.220	80.000	17.60	
THIN SEEDLINGS	HR.	4.650	6.000	27.90	
PEST LANNATE 1.8	ACRE	12.150	7.000	85.05	
CARTONS	CART	1.020	375.000	382.50	
HAND HARVESTING	HR.	4.650	112.500	523.12	
GRADING & MKTG	CART	1.330	375.000	498.75	
ANNUAL OPERATING CAPITAL	DOL.	0.130	73.339	9.53	
LABOR CHARGES	HR.	4.869	10.970	53.41	
MACHINERY FUEL,LUBE,REPAIRS	ACRE			30.02	
IRRIGATION FUEL,LUBE,REPAIRS	ACRE			10.73	
TOTAL OPERATING COST				1876.06	
FIXED COSTS		VALUE		YOUR VALUE	
MACHINERY					
INTEREST AT 13.0%	DOL.	88.182			
DEPR.,TAXES,INSUR.	DOL.	116.877			
IRRIGATION					
INTEREST AT 13.0%	DOL.	49.400			
DEPR.,TAXES,INSUR.	DOL.	40.300			
LAND					
INTEREST AT 0.0%	DOL.	0.000			
TAXES	DOL.	0.000			
TOTAL FIXED COSTS		294.76			
PRODUCTION:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
BROCCOLI	CART	6.800	375.000	2550.00	
RETURNS ABOVE TOTAL OPERATING COSTS				673.94	
RETURNS ABOVE ALL COSTS EXCEPT OVERHEAD,RISK AND MANAGEMENT				379.18	
TREFLAN .5 LB. AI; LANNATE 10 OZ. AI; SIDEDRESS 120 LBS. 34-0-0 FERT TWICE.			WICKWIRE,SCHATZER NOTES		
PROCESSED BY DEPT. OF AGRI. ECON. - OKLAHOMA STATE UNIVERSITY PROGRAM DEVELOPED BY DEPT. OF AGRI. ECON. OKLAHOMA STATE UNIVERSITY					

TABLE XXV

FALL BROCCOLI TRANSPLANT BUDGET

FALL BROCCOLI TRANSPLANT, OKLAHOMA SANDY LOAM SOILS, IRRIGATED, OWNED EQUIPMENT WITH HAND HARVEST 22 LB. CARTONS, ADJ. DALLAS WHOLESALE PRICE.					
OPERATING INPUTS:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
HERB TREFLAN 4E	ACRE	4.450	1.000	4.45	
15-15-15 FERT.	CWT.	9.750	3.000	29.25	
RNTFERTSPRD/ACRE	ACRE	1.250	3.000	3.75	
TRANSPLANTS	THPL	30.000	14.500	435.00	
TRANSPLANT LABOR	HR.	4.650	18.000	83.70	
NITROGEN (N)	LBS.	0.220	80.000	17.60	
PEST LANNATE 1.8	ACRE	12.150	4.000	48.60	
CARTONS	CART	1.020	375.000	382.50	
HAND HARVESTING	HR.	4.650	112.500	523.12	
GRADING & MKTG	CART	1.330	375.000	498.75	
ANNUAL OPERATING CAPITAL	DOL.	0.130	71.768	9.33	
LABOR CHARGES	HR.	4.881	12.211	59.60	
MACHINERY FUEL, LUBE, REPAIRS	ACRE			35.36	
IRRIGATION FUEL, LUBE, REPAIRS	ACRE			7.43	
TOTAL OPERATING COST				2138.43	
FIXED COSTS			VALUE	YOUR VALUE	
MACHINERY					
INTEREST AT 13.0%	DOL.	98.442			
DEPR., TAXES, INSUR.	DOL.	130.319			
IRRIGATION					
INTEREST AT 13.0%	DOL.	34.200			
DEPR., TAXES, INSUR.	DOL.	27.900			
LAND					
INTEREST AT 0.0%	DOL.	0.000			
TAXES	DOL.	0.000			
TOTAL FIXED COSTS		290.86			
PRODUCTION:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
BROCCOLI	CART	7.120	375.000	2670.00	
RETURNS ABOVE TOTAL OPERATING COSTS				531.56	
RETURNS ABOVE ALL COSTS EXCEPT OVERHEAD, RISK AND MANAGEMENT				240.70	
TREFLAN .5 LB. AI; LANNATE 10 OZ. AI; SIDEDRESS 120 LBS. 34-0-0 FERT. TWICE;					WICKWIRE, SCHATZER NOTES
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TABLE XXVI

FALL BROCCOLI SEEDED BUDGET

FALL BROCCOLI, SEEDED, OKLAHOMA SANDY LOAM SOILS, IRRIGATED, OWNED EQUIPMENT WITH HAND HARVEST 22 LB. CARTONS, ADJ. DALLAS WHOLESALE PRICE.					
OPERATING INPUTS:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
HERB TREFLAN 4E	ACRE	4.450	1.000	4.45	
15-15-15 FERT.	CWT.	9.750	3.000	29.25	
RNTFERTSPRD/ACRE	ACRE	1.250	3.000	3.75	
SEED	LBS.	200.000	1.000	200.00	
THIN SEEDLINGS	HR.	4.650	6.000	27.90	
NITROGEN (N)	LBS.	0.220	80.000	17.60	
PEST LANNATE 1.8	ACRE	12.150	4.000	48.60	
CARTONS	CART	1.020	400.000	408.00	
HAND HARVESTING	HR.	4.650	120.000	558.00	
GRADING & MKTG	CART	1.330	400.000	532.00	
ANNUAL OPERATING CAPITAL	DOL.	0.130	61.248	7.96	
LABOR CHARGES	HR.	4.859	10.836	52.65	
MACHINERY FUEL, LUBE, REPAIRS	ACRE			28.27	
IRRIGATION FUEL, LUBE, REPAIRS	ACRE			14.03	
TOTAL OPERATING COST				1932.45	
FIXED COSTS				VALUE	YOUR VALUE
MACHINERY					
INTEREST AT 13.0%	DOL.	82.369			
DEPR., TAXES, INSUR.	DOL.	109.398			
IRRIGATION					
INTEREST AT 13.0%	DOL.	64.600			
DEPR., TAXES, INSUR.	DOL.	52.700			
LAND					
INTEREST AT 0.0%	DOL.	0.000			
TAXES	DOL.	0.000			
TOTAL FIXED COSTS		309.07			
PRODUCTION:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
BROCCOLI	CRAT	7.010	400.000	2804.00	
RETURNS ABOVE TOTAL OPERATING COSTS				871.55	
RETURNS ABOVE ALL COSTS EXCEPT OVERHEAD, RISK AND MANAGEMENT				562.48	
TREFLAN .5 LB. AI; LANNATE 10 OZ. AI; SIDEDRESS 120 LBS. 34-0-0 FERT. TWICE.					WICKWIRE, SCHATZER MOTES
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TABLE XXVII
BELL PEPPER BUDGET

BELL PEPPERS, OKLAHOMA SANDY LOAM SOILS, IRRIGATED, OWNED EQUIPMENT WITH HAND HARVEST 30 LB. 18/9 BUSHEL CARTONS; ADJ. DALLAS WHOLESALE PRICE.					
OPERATING INPUTS:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
HERB TREFLAN 4E	ACRE	4.450	1.000	4.45	
15-15-15 FERT.	CWT.	9.750	3.500	34.13	
RNTFERTSPRD/ACRE	ACRE	1.250	2.000	2.50	
TRANSPLANTS	THPL	40.000	12.000	480.00	
TRANSPLANT LABOR	HR.	4.650	15.000	69.75	
PEST PYDRIN 2.4E	ACRE	8.200	5.000	41.00	
FUNG MANZATE 200	ACRE	4.220	12.000	50.64	
BACT KOCIDE 101	ACRE	11.360	9.000	102.24	
PEST SEVIN XLR	ACRE	5.770	6.000	34.62	
HAND HOEING	HR.	4.650	12.000	55.80	
NITROGEN (N)	LBS.	0.220	50.000	11.00	
CARTONS	CART	1.020	300.000	306.00	
HAND HARVESTING	HR.	4.650	120.000	558.00	
GRADING & MKTG	CART	0.760	300.000	228.00	
ANNUAL OPERATING CAPITAL	DOL.	0.130	179.595	23.35	
LABOR CHARGES	HR.	4.878	15.858	77.36	
MACHINERY FUEL, LUBE, REPAIRS	ACRE			45.35	
IRRIGATION FUEL, LUBE, REPAIRS	ACRE			10.73	
TOTAL OPERATING COST				2134.90	
FIXED COSTS			VALUE	YOUR VALUE	
MACHINERY					
INTEREST AT 13.0%	DOL.	129.883			
DEPR., TAXES, INSUR.	DOL.	171.131			
IRRIGATION					
INTEREST AT 13.0%	DOL.	49.400			
DEPR., TAXES, INSUR.	DOL.	40.300			
LAND					
INTEREST AT 0.0%	DOL.	0.000			
TAXES	DOL.	0.000			
TOTAL FIXED COSTS		390.71			
PRODUCTION:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
BELL PEPPERS	CART	9.960	300.000	2988.00	
RETURNS ABOVE TOTAL OPERATING COSTS				853.10	
RETURNS ABOVE ALL COSTS EXCEPT OVERHEAD, RISK AND MANAGEMENT				462.38	
SEVIN 1 LB. AI; KOCIDE 3 LBS. AI; TREFLAN .5 LBS. AI; PYDRIN .15 LB. AI; MANZATE 1.5 LBS. AI; 150 LBS. 34-0-0 FERT.					WICKWIRE, SCHATZER NOTES
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VITA

Jeffrey Francis Dale

Candidate for the Degree of

Master of Science

Thesis: THE ECONOMICS OF IRRIGATED SPECIALTY CROP PRODUCTION IN
SOUTHEASTERN OKLAHOMA

Major Field: Agricultural Economics

Biographical:

Personal Data: Born in Atoka, Oklahoma, February 9, 1962, the son
of Mr. and Mrs. Charles Dorsey Dale III.

Education: Graduated from Atoka High School, Atoka, Oklahoma, in
May, 1980; received Bachelor of Science in Agricultural
Economics from Oklahoma State University in July 1984;
completed requirements for the Master of Science degree at
Oklahoma State University in July, 1986.

Professional Experience: Graduate Research Assistant, May, 1984,
to July, 1986; teaching assistant September, 1984 to December
1984; Department of Agricultural Economics, Oklahoma State
University.